FOUNDRY TRADE JOURNAL

Established 1902

Vol. 82 Thursday, May 15, 1947 No. 1602

49, Wellington Street, London, W.C.2
'Grams : " Zacatecas, Rand, London "
'Phone : Temple Bar 3951 (Private Branch Exchange)
PUBLISHED WEEKLY : 21s. per annum (Home and Overseas)

Properties of Alloys

Evaluation of the properties of a metal or alloy is generally for one of two purposes. It is either for manufacturing processes control or to meet the requirements of customers. It is as well to bear this constantly in mind, because the tests required for the latter are not necessarily best for the former because of the time of preparation and the carrying out of tests. Then, in the actual furnishing of test data to users, there should be a better appreciation of ultimate use. The provision of tensile results on 12 per cent. silicon acid-resisting ferrous alloy is a waste of energy, as these would take a lowly position in a list of desirable properties. In the case of cast iron, there are not too many instances where tensile strength is of paramount importance, compression is certainly of equal significance, whilst for malleable castings, fatigue strength often plays the major rôle. Most castings, even though it be limited to the drilling of a few holes, have to undergo some form of machining and whilst this property is often talked about, little has been done to place the subject on a proper basis. Too much energy has been expended on attempting to correlate machinability with some other easily determined property, such as Brinell hardness. Generally speaking, engineers like to relate the lesser known properties with those he can easily visualise and apply through long experience. The late M. Cohade, of Le Creusot, had so correlated chemical composition with tensile properties, that he could forecast the tensile strength of a large range of alloys. This was interesting, but rather futile.

In the field of vitreous enamelling, the requisite properties of metals and alloys are very different from those which interest engineers. They still need investigation and listing so as to present a picture acceptable alike to maker and user. The new methods of evaluating surface perfection such as we have seen at the National Physical Laboratory are worthy of study, not only by those interested in enamelling, but in many cases of engineering application.

For rainwater goods, there is little wrong with the material normally supplied, but more attention should be given to erection, as much damage is caused by faulty erection, whilst for baths, the main factor in their deterioration is the drip caused by faulty washers. Here the cure is realistic propaganda rather than a search for an enamel impervious to staining. Thus it appears that for each class of casting there needs to be established and listed, in order of importance, the properties to be associated with their industrial applications. At the moment, one sees only too often the standard, well understood properties heading the list, whilst those not so well known, but of primary importance for some applications, figure almost apologetically at the bottom. Where now, only adjectives can be used as descriptive of properties, research must be continued until they can be enumerated and the figures so publicised that they become as familiar to the users as is tensile strength to the engineer.

There is less urgency in the provision of standardised tests for such properties as machinability and fatigue strength, as there is for the placing of tensile strength and Brinell hardnesses in their proper perspective. For far too many applications, tensile strength figures are demanded and these are by no means cheap to produce. Moreover, the demand tends to grow. By all means give the customer a picture of the real properties he seeks and, if correlation satisfies him, then let the basic test-piece be a cheap one to prepare.

Contents

Properties of Alloys, 43.—Reunion Luncheon, 44.—Engineering and Marine Exhibition, 44.—Photography in the Foundry, 44.—Iron and Steel Institute, 44.—New Plant at Bayonne, 44.—Vitreous Enamel Finishes, 44.—Practical Elements of Machine Moulding, 45.—U.S.A. Copper Duty Suspended, 51.—Notes from the Branches, 52.—Engineering Properties of Heat-treated Cast-Iron, 53.—Three Factors Affecting Industrial Activity, 57.—N.E. Coast Institution of Engineers and Shipbuilders, 57.—Siemens Bros.' Capital, 57.—Personal, 58.—News in Brief, 60.—Price of Quicksilver Reduced, 60.—Gauge and Tool Advisory Council, 60.—Obituary, 62.—Stock and Sales of Non-ferrous Scrap, 62.—Steel Company of Wales, 62.—Contracts Open, 62.—Recent Wills, 62.—Company News, 64.—Raw Material Markets, 66.

Reunion Luncheon

Light Castings Manufacturers

The first social event organised by the manufacturers interested in the production of castings for the building trades—British Ironfounders' Association, British Bath Manufacturers' Association and the National Light Castings Ironfounders' Association—since war broke out took the form of a luncheon party. It was held at the Dorchester Hotel, Park Lane, and was presided over by Mr. W. R. Blair, M.C.

The toast of the "Light Castings Industry" was proposed by Mr. H. H. Beresford, President of the Joint Iron Council, and in his speech he gave much useful information both as to commercial and technical trends in modern industry, drawing upon his recent visit to the States. The chairman, in reply, gave figures which showed the post-war recovery of the industry. It seems that during the war the production of baths was reduced to 10 per cent. of pre-war, cooking and heating apparatus 50 per cent., and rainwater goods to 15 per cent. The recovery was such that to-day baths have attained 80 per cent. of pre-war production, cooking and heating 100 per cent., and rainwater goods 75 to 100 per cent. This represents a very creditable effort, as, since the war finished, the managements have been concerned with mechanisation, whilst being handicapped by shortages of all types.

The toast of "The Guests" was proposed by Mr. A. C. Bernard, manager of the Carron Company, who, instead of naming the many distinguished people present, contented himself with referring to the interests they represented. The only name he mentioned was that of Mr. A. A. Saunders, Co-ordinator for Housing Production, who responded.

Engineering and Marine Exhibition

The catalogue of this exhibition at Olympia to be held from August 28 to September 13 is now available. The Foundry Section has 24 exhibitors, of which a dozen or so make plant and a like number supply raw material. There are, however, quite a number of exhibits selling to or giving service to the foundry industry in other sections. It is an interesting commentary that the Welding Exhibition is much larger than the foundry equipment section. All told there must be about 450 stands, which is obviously sufficient to provide interest for a full day's visit for any technician. Lt.-Col. Lord Dudley Gordon, D.S.O., is president of the Exhibition and the organisers have the co-operation and goodwill of most of the technical organisations to be associated with engineering and metallurgy.

IN OUR APRIL 10 issue, in the article by Dr. Pell-Walpole on "Improvements in Hollow Sticks and Billets by Casting on to Metal Cores," we repeatedly printed the trade marked material "Alundum" as alundum. We regret the error.

Photography in the Foundry

The latest exhibition of Kodak Limited, showing the industrial significance of applied photography, is of great importance to foundrymen. The full possibilities of the use of photography in the foundry are clearly demonstrated in a series of photographs showing X-ray detection of casting faults; how templates made by photographic means can speed production of casting patterns; how films of gating technique will standardise practice and raise output; how testing of metal before pouring is possible; determining the material composition of metals and finally the latest X-ray diffraction process, a new approach to the preparation of alloys and prediction of properties.

By the time this appears in print, the London exhibition at Australia House will be over, but we are assured that later this year the exhibition will tour Birmingham, Leeds, Glasgow and Bristol, with the possibility of other towns if suitable accommodation can be found. Foundry metallurgists would do well to pay it a visit.

Iron and Steel Institute

Details are now available of the forthcoming visit to Switzerland. This is to take place from July 9 to July 15 or 18. There are to be two technical sessions, the choice of a dozen or more works visits, and a wide range of sight seeing excursions. It is an excellent programme and intending participants should write immediately to the Secretary of the Institute at 4, Grosvenor Gardens, London, S.W.1.

New Plant at Bayonne

In an address to the shareholders of the International Nickel Company of Canada, Limited, Mr. Robert C. Stanley stated that a plant for the manufacture of precision castings has been completed in Bayonne and operations have started. These castings provide intricate cast shapes which require no finishing. The castings are accurate and have the appearance of machined metal. The initial capacity of this plant is 25,000 pieces per week.

Another foundry product, Ni-Rod Welding Electrode, developed principally through research, was established last year. This rod is for welding cast iron and it is believed that research has developed a very valuable nickel product.

Vitreous Enamel Finishes

The British Standards Institution, 28, Victoria Street, London, S.W.1, have just issued a chart, BS 1358:1947, illustrating the range of colours now normally available for the production of domestic appliances carrying a vitreous enamel finish. Bathroom fixtures are not included. Fourteen colours are shown and a table gives quality and brightness factors.

Both the Institute of Vitreous Enamellers and the British Colour Council have collaborated in this work, which is available at 2s. post free.

Practical Elements of Machine Moulding*

By F. J. Bullock

The elements of machine moulding exist in the use of turn over boards, and, in plate moulding, devices which are employed to a greater or less extent in nearly all shops. Turn over boards, joint boards, bottom boards, as they are variously named, are employed to facilitate the making of the joint faces of moulds. But when similar work is often repeated, the joint faces are rammed directly upon boards, the contour of the faces of which corresponds with that of the joint faces of the sand—flat, if required flat; irregular, sloping, curved, etc. if so needed. In the simplest mould, the flask, which is to become the bottom or drag, is laid upon the bottom board over the pattern, rammed, lifted off with the pattern or portion of the pattern belonging thereto enclosed *in situ*, turned over, and the cope rammed upon it. This method is very advantageous in two cases: first, when the pattern is so flimsy that it would probably become rammed out of truth, or could only be kept with difficulty from winding during ramming; the second, when the parting joints are so uneven, unsymmetrical, curved, sloping, and irregular, that to cut and sleek them with the trowel at each time of moulding would entail much loss of time.

Plate Moulding

Plate moulding is an advance upon this practice. Using turn over boards, the cope is rammed on the drag, joint to joint, in the positions which both are to occupy finally at the time of casting. But in plate moulding, the joint faces are not brought together at all, until the time of final closing. The pattern is divided into two portions, one portion being upon one side of a plate of wood or metal, the supplementary portion being upon the opposite side. Or, in many cases, distinct plates are employed, each carrying that portion of the pattern which is the supplement of the portion on the other plate.

Cope and drag being rammed, each on its respective side of the plate, or on its separate plate, form when brought together a complete mould, corresponding at the joints. Thus, taking an example, the trolley wheel shown in Fig. 1 would, if moulded on a plate, be made as shown. It is clear that the portion of the wheel on the face B of the plate is supplementary to that on face C. The faces B and C form the point faces of the drag and cope. Patterns like these are arranged singly or in series on plates, according to size and quantity required. A pattern of large size will occupy a plate to itself; several small patterns, alike or dissimilar in character, may be arranged on one plate, and poured from a central ingate and spray of runners.

*A Paper (abridged) read before the South African branch of the Institute of British Foundrymen.

Joint Boards

The difference between the solid pattern used on a joint board and the divided pattern on a plate, is due to the difference in the methods of moulding. In the first case, one-half the mould is rammed on the other half—the latter being the one which is rammed on the board. In the second case, the mould parts are rammed independently of each other, and they do not come together until finished. In both cases, there is much economy over the ramming of patterns by the ordinary method of turning over, in which the joint has to be prepared by the trowel of the moulder. Both in joint board and in plate moulding, the joint is made at once by the face of the board or plate. But the latter also saves time in the lifting out of numerous patterns, besides which it is a more permanent arrangement, and one moreover that lends itself to economies, such as arrangements of runners and the use of separate plates for top and bottom boxes. Also, the system is more adaptable to the preparation of patterns and plates, in which the joint faces, instead of being flat, are sloped, curving, or otherwise irregular in contour.

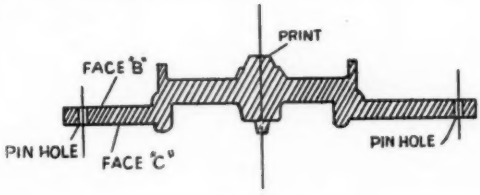


FIG. 1

There is no essential difference in plate-moulding and in moulding done on a machine; in fact, the plates will frequently interchange, and in the case of small patterns, several are mounted on a plate and the runners also are suitably disposed thereon. The utility of a moulding machine consists largely in this, that in place of the clumsy and often inaccurate separation of the pattern plates from the flasks by hand, there is substituted the steady, equal, and perfect separation by mechanism. Some of the more useful machines include much more than this, such as the ramming or pressing of the sand around the patterns, and the use of stripping plates (that is, plates through which the patterns are drawn, the plates sustaining the sand and preventing broken edges). Such elaboration is not essential to machine moulding, though often convenient and advantageous.

The rapid growth of machine moulding is one of the most remarkable features of present foundry practice. The machines made now number several

Practical Elements of Machine Moulding

scores of distinct designs, though the broad types may be reduced to less than a dozen. To understand the essential differences between these types it is as well to consider the principal stages in making moulds, which include ramming, turning over, rapping, and withdrawal and closing, the dimensions of moulds, and the case of repetitive work. Each of these aspects of moulding have occasioned the evolution of board and distinct types of machines, while many machines are built to combine more than one of these cardinal features.

Ramming

This is the subject which naturally arises first in any question of machine moulding. Because it is the most difficult feature to embody in a machine, is the reason why, notwithstanding hundreds of patented devices, only a minority of machines to-day include provision for complete mechanical ramming, though the number is increasing. The majority are still built for hand ramming, though these usually include a

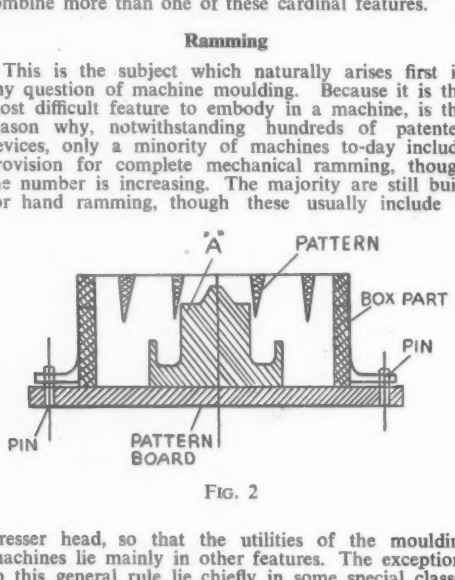


FIG. 2

presser head, so that the utilities of the moulding machines lie mainly in other features. The exceptions to this general rule lie chiefly in some special classes of work which are largely repetitive, in consequence of which considerable expense can be incurred for blocks having irregular contours, more or less approximating to the form of the pattern, and by means of which the force of ramming can be graduated.

Something of this kind is essential, the cases of shallow patterns excepted, or those with fairly level faces over which the sand can be pressed and consolidated equally by a flat pressing plate. It seems hardly necessary to explain the reason for this. The moulder knows well how the force of ramming is varied continually, and almost unconsciously, over different sections of the same mould, as well as in moulds made of different mixtures of sand, and that such ramming is done sideways in undercut portions under flanges, lugs, bosses and so on—work which no machine can imitate perfectly. It may be stated that almost any class of work, even though irregular or intricate, can be rammed by power, if the number of castings required is sufficiently numerous to warrant the cost of ramming appliances. The question then is one of relative cost. Sometimes moulders are apt to blame the machine, when the mould is not the correct hardness at particular points, which is due to moulding box design (*e.g.*, if a bar comes down too close to the pattern and forms a converging corner, a hard spot will be created and further down there will be a soft spot as shown in Fig. 2).

The turning-over of the parts of moulding boxes, when done by a machine, avoids the risk of the sudden shock and fracture of sand which sometimes follows from a clumsy turn-over done by hand. Sometimes it is the pattern plate alone that is turned over, sometimes the moulding box on the plate. But in any case it is always done steadily, and the plate, or the box, is locked in a truly horizontal position, and also at a height at which it is convenient to work, instead of lying down on the ground.

Rapping and Withdrawal

The delivery of patterns from moulds when done by hand is commonly a cause of enlargement and variations in the sizes of moulds and often of fracture of the sand, which, when mended up, tends to produce variations in the dimensions of moulds. The larger a mould is, the more risk is there of such accidents happening, because of the difficulty of getting a truly level lift, when two or three men are lifting at once, or when the crane has to withdraw a pattern. The principal value of very many moulding machines, therefore, lies in the simple fact that patterns and moulds are separated through the medium of rigid slides instead of by the unsteady action of the human hand, or of the crane. So valuable is this feature that many moulding machines embody no other provision besides this. Subject to the condition that patterns are made well and there is no fracture of sand, a hundred moulds made from the same pattern will show no variations in size.

Rapping is done with a vibrator usually of the pneumatic type attached to the machine or board. On some machines, when purchased, this vibrator is fixed to the heavy solid frame or turning-over board, which, to have any useful effect, has to vibrate an enormous mass of metal. A more effective arrangement is to attach this apparatus to the pattern board itself, which gives it a more direct contact with the pattern and does not have such an enormous mass of metal to vibrate. The direction of vibration is very important, such as attaching the vibrator in order that it moves the pattern in the sand, causing a clearance between the pattern face and the mould face. An improvement is also obtained by placing two vibrators on the pattern board at right angles to each other, the reason being, that all pneumatic vibrators act only in a linear direction due to the piston travelling up and down the cylinder. The noise a vibrator makes is also not a function of the magnitude of the vibration, which is apt to mislead many moulders. Whenever the number off warrants the cost, a stripping plate should always be fitted.

Repetition

The production of repetitive work on a large scale has been the cause of the development of the portable types of machines, of multiple moulding, and of numerous adjuncts to fixed machines of ordinary and of special types, such as tracks, conveying systems, cranes, etc. This aspect alone opens up a very wide field of interesting detail which illustrates the numerous and varied ways in which similar results are secured. For though the small light machines may be moved along the floor, leaving their work behind them, the large heavy ones must be fixtures and the work must be brought to and conveyed from them. Conveying systems also deal with the sand and the moulding boxes. In some shops these systems have become very highly developed.

The practice of machine moulding is adaptable to all classes of work that lie within the capacities of the machines. Like die-forging, it is suitable alike for a limited number of articles only, or for hundreds or thousands of similar parts. The cost of the pattern work is mainly controlled by the numbers of castings required; ordinary cheap patterns of wood for a few moulds; high-class, well made patterns of metal when hundreds or thousands of moulds have to be taken therefrom. So that moulding machine practice ranges from that in which ordinary patterns are mounted on plates, as in the plate-moulding which is done by hand and put on the machine, to those in which metal patterns on plates are got up in the best possible manner for use on the machine alone. Between these extremes, every grade and method of pattern work is represented in machine moulding. Formerly, too, only simple patterns were attempted, but now many intricate forms are used. The simplification of the moulder's task also follows, with the result that men who have not had the moulder's training, or mastered any section of the moulder's craft, are able in a few weeks to operate machines.

Patterns

As in ordinary hand moulding, patterns are either unjointed or jointed. In the first case, a plain top only is wanted and then the pattern is mounted on one side of a plate. In the second case, the pattern parts or halves, as the case may be, are mounted on opposite sides of one plate, or each on one side of two distinct plates, which may be moulded on the same machine by one man, or on different machines by different men. The matching of the moulds depends on the degree of care and accuracy with which the pattern maker has done his work.

Patterns for a moulding machine must be of the very best as regard workmanship and taper in order that they may leave the mould freely. Untrue faces and undercut will definitely result in bad drawing from the mould. All corners must be filleted with wood or some hard plastic that will not come loose or become softened. When the number required does not warrant a stripping plate and the pattern is merely fixed to the pattern board, a small plastic fillet all around the pattern against the board is a very useful aid in getting a perfect draw and the small fin it leaves is easily fettled off during the dressing process.

Machine Selection

A point to be emphasised is the futility of pinning one's faith and practice to one class of machine. No matter how excellently designed and economical a machine is, there is always another that will go a point better on certain classes of work and operated under different conditions. That is the reason why a firm should feel its way in laying down plant of this character and not order a lot of machines of one type, if the range of work done is of a varied kind. The case is paralleled by that of machine tools. No sane manager would fill a shop with machines of one build and type, unless, of course, the character of the work done was uniform, as in the case, say, of ranges of screw machines, or gear cutters, always operating on the same kinds and nearly the same sizes of work.

With regard, again, to dimensions, the size of a single pattern alone is not only the governing question, since it is often more economical to put several patterns on one large machine than to have single patterns on smaller machines. This holds good not only in relation to very small patterns that are commonly grouped thus, but to those of comparatively large dimensions, which can be moulded on oblong machines of several feet in length. Another advantage in using such machines is that top and bottom box parts may be, and often are, rammed on one side of one plate at once, not of the turn-over type.

The method of operation is an important governing condition when one considers machines of very large dimensions, for it is obvious that however well counterbalanced a table may be and though human power may be multiplied and used to the best advantage, with levers and with worm gear, there is a limit to its employment beyond which hand operations cannot be conveniently and economically carried. This is the opportunity for the power machine, and this raises the broad question of power operation.

Hand or Power Machine

Generally this should be settled by the character of the plant already existing in a shop, or of that which it may be contemplated to lay down. All progressive foundries are now equipped with power of some kind, as steam or water power for cranes, air or electricity for hoists, and other purposes. Of hydraulic moulding machines there is a greater choice than there is, as yet, of steam or of pneumatic machines. In view of the recent rapid growth of air-operated machinery, which has been shared by the foundry in common with other departments, one may anticipate that pneumatic moulding machines will be in much greater demand in the future than they are yet. If the question is one of laying down power plant in a foundry as yet unsupplied with power, it may be pointed out that a pneumatic plant is less expensive and less bulky than a hydraulic one. Air-compressing plants are very suitable for small foundries, and they serve also for hose-piping for blowing out moulds, in

Practical Elements of Machine Moulding

place of bellows: and a few air hoists also are more handy than fixed hydraulic cranes. None of these questions can be settled off hand, but each separate shop must work out its own problems, independently of the governing conditions of others.

One of the simplest machines that can be made, is a mould press. Ordinary boxes and snap flasks are moulded on it. Preliminary ramming may or may not be done by hand, according to the outline of the pattern. The final pressure is imparted to the top and bottom of the moulds, to which presser-boards are fitted, by the downward pressure of the hinged head, actuated through toggle levers by hand. The levers on opposite sides of the machine are connected by a horizontal shaft. The height of the presser-head is adjusted to suit boxes of different depths by means of the nuts on the screwed rods. There is no mechanical delivery, patterns being rapped and withdrawn by hand in the ordinary way. But the saving in time is very considerable on repetitive work.

Advanced Hand Machine

A hand machine of more advanced type, which has been in successful use during many years, is made in a large range of dimensions, both for general work, for specially deep work, and for stripping plates. The machine is designed for hand ramming, and no special pattern plates are necessary, since any patterns of suitable size, either in wood or metal, can be mounted on the table. These machines are specially designed to take deep and heavy boxes, with which object it is made rather differently from those which are built for small and medium work of a general character. Though the general design is similar in both instances, the differences are that gearing is used in some machines for operating the turnover table, and then the elevation is done by racks and gears instead of by simple movements of a lever. But with these exceptions the same general description will apply to each.

The standards used carry the mechanism between them; they are built at various distances apart, ranging from 30 in. upwards to about 16 ft., to suit boxes of different lengths, and are maintained apart by stretcher bolts and a bottom casting, while the larger machines are also bolted to a baseplate. The pattern is fixed to the upper face of the top table, which is of the turn-over type, and the box is placed over this and rammed by hand. It is retained in place by means of screws and sockets which are adjustable for different depths of boxes, or in the case of light work, by spring clips. The table is fitted with trunnions of large diameter, in capped bearings in the standards. Set screws, with large nuts, afford the means by which the table is adjusted for level without further check, and it is prevented from moving by the catch handles above. In the machines for general service the trunnions are placed in the centre of the table. But in machines for deep work they are placed eccentrically in order to come more in line with the weight of the pattern and moulding box. But they are arranged in or out of centre, in either machine, to suit requirements.

When the pattern has been rammed, the catches above are removed, the table is turned through half a revolution and relocked, leaving the moulding box with its contained mould and pattern suspended from the underside of the table. At this stage another portion of the mechanism, the lifting table, the bottom one, is brought into operation. This is a ribbed plate, underneath which, two turned stems or pillars are attached with bolts through flanged ends on the pillars. These are the means by which the lifting table is elevated and depressed through the action of slotted links hidden within the base, actuated by two levers on a horizontal shaft, which is turned by a long lever. The total mass of these parts is counterbalanced by a weight. The effect of moving the lever is to bring the table up towards the back of the box that has just been rammed. In the deeper class of machines the table is lifted by cylindrical racks. These slide in bored sockets, and are actuated by hand wheel and gears. The raising and lowering of the table are performed with ease, because the weight of the latter, together with that of its load, is counter-balanced by adjustable weights, which descend into the foundations.

The table is lifted up until it presses the carriage against the back of the rammed box. The clamps are then released and the table lowered, the mould descending with it away from the pattern. During the period of this delivery, the upper surface of the turn-over table is rapped with a mallet to assist the separation of the pattern from the sand.

The mould is now left lying on the carriage, immediately above the lower table, on which it is drawn away by means of rollers beneath the latter, to the receiving rails in front, which, being clear of the machine, permit the mould to be lifted off and taken away. The carriage is of wood, and its movement is controlled by flanges on the ends of the table. The receiving rails are similarly flanged, and form the top edges of cast-iron brackets, which are bolted to the front of the machine. The empty carriage is now pushed back on the lifting table, and the turn-over table revolved to bring the pattern on its upper face ready for the next box.

Scope of Machines

A machine of this kind is of great value in any foundry, even where few specialities are handled. Any ordinary pattern within its range can be taken and put on the table and moulded with a perfectly vertical lift. It will pay to use the machine for two or three moulds only. When a plain top only is required, the latter can be rammed on the plain table. When patterns are jointed, their halves or parts must be fitted on opposite sides of the table, or be fixed on separate machines, which involves some fitting that would not be justified for two or three castings, though in this respect the machine is quite adaptable in firms that have not much specialisation. But outside of these there are many cases in which the patterns are cast with the turn-over or swivel table, as

in labour-saving repetition work. Patterns are specially mounted in three ways—on a false-part box, or on thin cast-iron plates exactly as used in many shops for plate moulding without the assistance of a machine, or mounted in plaster-of-paris.

In all these cases, the piece carrying the pattern, or patterns, is capable of being attached simply and rapidly to the turn-over table by a couple of bolts, and the usual practice is to mount the bottom-part pattern on the table, make the required number of half-moulds, and then replace it by the top-part pattern; the change of patterns being only the work of a few minutes.

Jolt Ram Turnover

The most useful and versatile machine is the jolt ram and turn-over type which consists of a vertical cylinder which carries the plate and box. Where the latter is rammed by jolting and before turning over, a top rammer squeeze is brought into position and the back of the mould squeezed. After the back is rammed the whole plate and box part is turned over, lowered on to a table and the cotters knocked out and the pattern is lifted by the cylinder that did the jolting. This type of machine has the advantage that the pattern is withdrawn from the mould and not the mould from the pattern, which is often the reason for a bad lift due to the force of gravity assisting the mould to fall away.

Sandslingers

The next most useful machine is the well-known "Sandslinger," which consists of a radial arm on the end of which is attached a fast revolving sand impeller which is fed with sand, and it throws the sand into the mould at very high velocity, which results in the sand being rammed firmly. This type of machine has many advantages: all the mould is rammed evenly and any undercut face can be rammed obliquely as desired; almost any size box can be rammed with ease. As a matter of fact almost all other types of machines seem to treat the ramming as the least important, whereas it really is the most important in so far as it is the "donkey work" in the foundry industry and must be done properly. The Sandslinger is the machine to do this heavy work properly, and leaves the easy work to the moulder.

It is felt that the moulding machine is an asset to all concerned in so far as it will make the foundry pay more handsome dividends, improve working conditions, make moulding easier, make patternmaking a necessity instead of a necessary evil and, last but not least, result in the production of good, sound and perfect castings.

DISCUSSION

Mr. Jane said Mr. Bullock had brought forward an idea for flat ramming, which could be commended up to a point. In general, foundries in South Africa were jobbing machine foundries, producing a variety of castings which required heads, runners, etc., in various positions. This necessitated bars of irregular shapes placed at irregular intervals, which meant that in order to get a complete flat ram, blocks of timber had to be made to fill the squares fully. A standard pattern was therefore impossible. With a run of, say, fifteen, Mr. Bullock's method worked extremely well, but if ten castings had to be produced with the boxes running diagonally, the box had to be changed. Another point was that in steel foundries, moulding boxes were usually made in steel. When boxes were put into stoves, they distorted badly. The pin holes in the boards and the moulding boxes to accommodate them were drilled very accurately, but putting the boxes into the stoves resulted eventually in distortion. Years ago he saw a method adopted whereby machine boxes were provided with a round hole in one lug and a slot cut in the other lug. One round pin and one square pin were used. It was costly to prepare a set of boxes without full information on the subject, and he would appreciate Mr. Bullock's comments.

Blocks for Flat Ramming

Dealing first with the question of blocks for flat ramming the back, Mr. Bullock pointed out that most foundries had at least fifty boxes of a particular size. When these boxes were in process of being made, the ramming blocks for the machine were made at the same time. If only ten castings were required from one particular box, the next box went on and the pattern plate was changed. It should not be difficult to have the plate fitted with a couple of bolts, so that it could be easily changed. On the subject of bars, Mr. Bullock said that the blocks need not fit extremely accurately, so long as some form of efficient ramming could be effected. It might be necessary sometimes for the moulder to pick up a rammer and give it a couple of rams on the top, but in general his work was enormously reduced. As regards pins, he had not seen Mr. Jane's suggested method employed, but a box could be made that way. He considered that it was the only successful method of putting steel boxes in the stove and using them on the machine. There was nothing which could go wrong, particularly if a pin with a square face was used.

Mr. Teubes was of opinion that sufficient attention was not paid to design of boxes. When difficulty was experienced through sand not packing underneath boxes, this was definitely due to faulty design. Bars should have a feather edge to assist the sand to flow. Sand was extremely important to moulding, one vital point being flowability. The majority of the sand used in moulding machines lacked flowability, which was a point in favour of synthetic material. Since synthetic sands had flowability to a large extent, he considered that they should be employed wherever there were moulding machines. Then moulders would not have to worry about the sand, which would come to the machine ready for use, the type of work determining the mixture used. Referring to a query he had received on the subject of a machine sand for light castings, Mr. Teubes said that the question of physical consistency tied up with moulding machines.

Mr. Bullock agreed with Mr. Teubes that flowability was necessary for the sand to pass under the bars, etc.

D

Practical Elements of Machine Moulding

It was really very difficult to cancel out all the vertical distance the sand had to travel and allow it to flow under. He himself had not made extensive investigations into moulding sands.

Mr. Tonge asked whether the fault might be due to neglect of sand preparation, if at the end of the day perhaps 30 per cent. of scabbed castings were produced by a jolting machine turning out a hundred castings of, for example, small valves.

Mr. Bullock said there was much to consider. Sand preparation was but one point. It was possible that if the valves were redesigned no scabs would be obtained. The best procedure was to investigate where the scabs were forming. If they were in the same spot each time, he would be inclined to think that the fault lay in the design of the valve. It might be that a bar was located in an unsuitable place.

Mr. Tonge explained that he was assuming a standard type of article, of which thousands of successful castings were produced. He suggested that the sand preparation must be at fault, and that this should be the point of attack.

Mr. Teubes emphasised that possible faults should be eliminated one at a time, very likely starting with the sand. Every batch of sand could be standardised, any batch not up to specification being scrapped. Other points for investigation were whether the moulder was giving the same amount of rams to each mould, and whether the design of box was suitable for each use. Once every variable was eliminated, a simple cause would probably be found.

Pin Holes

Two further possible causes of scabbing added by Mr. Ward were variation in air pressure, and variation in metal temperature.

Mr. West agreed with Mr. Bullock regarding the design of the box and bars, but did not agree that stripping plates were necessary in the pattern moulds for machine boards. He was of opinion that stripping boards had been introduced in the early days, when they were very necessary in some cases. In cases where there were an efficient moulding machine and vibrator and a good pattern, he did not think that stripping places were necessary. The only case he could think of where they were necessary was gear wheels. Mr. West maintained that Mr. Bullock's method of using pin holes for mounting patterns on plates was becoming obsolete. Nowadays the tendency was to have a metal frame with holes drilled in and a pattern board inserted, the frames being fitted permanently to the machines. He considered that this was the best method of mounting patterns, and it was one which he had employed successfully from time to time. Where joints required watching was when two half-patterns had to be mounted on two separate boards. He described a method for ensuring that the two boards were exactly opposite, in which a very thin cardboard tacked on with glue was used to mark out the centres accurately. A valuable method, not generally known, was to arrange the plate so that it was exactly twice as long as it was wide. This was very useful, because in a jobbing shop it was possible to standardise the size of the machine boards. In this way two boards could very often be placed in the machine, a master frame being provided in the pattern shop for that purpose. All the tops and bottoms could be made from the same plate by simply reversing the box. Mr. Bullock had also mentioned the point that very often a board had to be made not flat, but with a slight contour. Had he ever given serious thought to whether he could make a pattern with an all-metal face?

Metal Faces

Mr. Bullock agreed that Mr. West's method of mounting patterns was very good. He had seen it in operation. The production of patterns with an all-metal face was very difficult, and the only way he could get anywhere near it was by a plaster-of-paris method. The pattern was put down on a board. Some small ribs were cut out in timber and nailed to the board, the whole thing then being filled with plaster-of-paris.

Mr. West emphasised that an all-metal face could be provided, and hoped at a later date to give a Paper on the subject.

Mr. Holdsworth did not agree with several points in the Paper. He had tried Mr. West's idea of plates. It had cost thousands of pounds and had to be scrapped. Wooden boards could not stand up to the wear and tear of the jolt, squeeze, strip machine, *i.e.*, where jobs with a very neat cross joint had to be made. The Sandslinger was one of the most universal and adaptable machines for the general jobbing foundry in ramming jobs for any type of machine. It was made to be lifted by a crane and put down on the job near the machine. It could not ram tangentially, however, and the way to use it was to ram up to the point where the tangential ramming was required and then by hand. A Sandslinger could ram three cub. ft. per min. Referring to Mr. Jane's query regarding the feasibility of having a slot at one end and a fixture at the other, Mr. Holdsworth said Mr. Jane could safely go ahead. There was no need to have a square pin, for the elongation of the slot would take care of any change of length.

Mr. West pointed out that the boards put into a frame need not be wooden. He had often used metal ones with great success. Much depended on how the metal board was constructed. He had made thousands of castings off one board. The occasion could sometimes arise when one machine was making tops and another bottoms.

A member asked whether Mr. West had ever had any difficulty getting plates out due to packing of the sand. That had been his trouble with wooden plates as well as metal. Replying to Mr. West, he said that the plates were tapered. Mr. West said that was where they had gone wrong.

U.S.A. Copper Duty Suspended

By "Onlooker"

The latest move in the affairs of copper is one which many people thought could never happen, at any rate this was a pretty definite conviction in pre-war days. In a word, the 4 per cent. import duty on foreign copper entering the United States is virtually dead, for a Finance Committee of the Senate has declared in favour of its suspension for two years, and it can be taken for granted that this recommendation will be adopted. The struggle has been a long one, but the Bill was passed through the House of Representatives some weeks ago, and it was generally believed that this time the protagonists of a system of free entry for copper would prevail. Broadly speaking, the measure has been favoured by those fabricators who stand apart from any copper producing unit, while the opposition has come from high cost mining interests. That the statistical position of copper in the United States is out of balance cannot be denied and an examination of the monthly figures over the past years shows that domestic consumption has only been provided for by adding to the contribution made by the U.S. mines a generous addition of foreign copper, most of which went in from South America, Canada and Mexico. This was satisfactory during the war when the government paid the duty, or, as it was said at the time, "absorbed it," but since the end of last year the industry has been left to work out its own salvation and it very quickly became apparent that with the stock-pile virtually exhausted, something would have to be done if a lop-sided situation was to be avoided.

The 1929 Moves

It is fifteen years since the 4 per cent. import duty on foreign copper was adopted by the Americans during a period of depression following the slump of 1929. The price of the metal was extremely low and the great copper producing industry was seriously weakened, for in those days, at any rate, the average cost of production in the United States was above the level ruling in Chile, Rhodesia and the Belgian Congo. Consumption did not amount to anything like the figure it stands at to-day, and stocks in the hands of the producers were high, for the industry was still suffering from the period prior to the price break in 1930 when the price of copper was held at 18 cents long after this level was quite unjustified. When the United States decided to put a tariff wall round its domestic industry of copper production, an agitation was set up for a similar barrier in the United Kingdom, with the proviso that Empire brands should come in free of duty. This claim was pressed to the point of a duty on foreign copper at 2d. per lb. (about £19 per ton) being placed on the Statute Book, but it was deemed expedient, following representations by the consumers, to hold this in abeyance and in consequence it was never implemented. Foreign lead and zinc, however, carry an import tax which has never been repealed, and it should be remembered that a similar condition of affairs obtains in the United States.

A Decline in Price Forecast

The first result of the announcement that the U.S. copper duty would be lifted has been a rise in the price of the metal by about 1 cent per pound, and at the time of writing the quotation for export is 23¾ cents, while the domestic market seems to be at somewhat the same level. It may be taken for granted that so far as extra-American brands are concerned, the U.S. fabricator must pay at the same figure as users in Britain, or perhaps it would be more correct to say, on the same basis as the British Ministry of Supply. What is in some doubt is the quotation which will be maintained by the U.S. producers, and this is likely to be dictated by the two chief companies whose interests are widespread. Since the volume of imports, for some time, at any rate, is likely to be large, it seems likely that the country will settle down to one price for home and imported metal, and this may well go on until the London Metal Market is re-established. Since reserve stocks of copper in the States have declined to rather a low level, demand for a time is likely to be insistent, and this must make things more difficult for European interests, including Britain, who will be up against this trans-Atlantic competition. But it is already being suggested that the second half of this year will see a change in the tempo of the United States activity in copper consumption, and it cannot be too strongly stressed that such a development would be quickly reflected in the price. This stands at an unwarranted and inflated level which cannot fail eventually to lead to a marked expansion in mine production and incidentally to a falling off in demand. Aluminium is a keen competitor, a fact much more apparent in the United States than it is here. For example, across the Atlantic the trend is all towards the employment of the lighter metal for power transmission lines. But let us not make the mistake of believing that similar developments will not occur here!

Foundry Statistics

The Monthly Statistical Bulletin issued by the British Iron and Steel Federation for March confirms the employment trends previously noted. Thus, at the week ending January 4, there were 132,877 engaged in the ironfounding industry, which registers a gain of 2,446 during the month, but a loss of 90 females. As would be expected, the production of steel for steel castings fell in February to 5,800 tons, as compared with 6,800 in January and 6,600 in February in 1946. Deliveries were similarly affected. Only 2,200 were despatched as compared with 3,000 tons in 1946.

Notes from the Branches

London Branch

Annual General Meeting

The Annual General Meeting of the London Branch of the Institute of British Foundrymen was held in the Waldorf Hotel, London, W.C.2, on April 23, Mr. G. R. Webster (retiring Branch-President) in the chair. The Branch-President welcomed Mr. Tom Makemson, General Secretary of the Institute, to the meeting. The minutes of the last annual general meeting were taken as read and were confirmed and signed.

MR. F. ARNOLD WILSON (hon. secretary and treasurer) presented his report on the activities of the Branch for the year 1946.

He said that the return to peace conditions had resulted in very close co-operation between the office-bearers.

Last year there was what was then a record figure of 557 members, while to-day they totalled 607, an increase of 50 and the highest figure yet reached.

The Branch had been honoured by having one of its Past-Presidents, Mr. R. B. Templeton, as Junior Vice-President of the Institute. Another great distinction was that a Past-President, Mr. V. C. Faulkner, had been appointed President-Elect of the International Committee of Foundry Technical Associations. Dr. A. B. Everest was to receive the Oliver Stubbs Gold Medal.

More Papers Needed

More Papers from members of this London Branch were needed. Suggestions did not always work. Saturday meetings at the request of South Coast members did not turn out as expected. Very few South Coast members attended and the total Saturday attendances were fewer than on the Wednesday ones. Meetings would take place on Wednesdays in future.

This past session started with the President's Address, when he showed us all that it would not be his fault if the Branch did not forge ahead with enthusiasm. Mr. Logan and others reported on the work of the Technical Committee, which made everyone realise how much they owed to these men.

Largely due to prevailing conditions, no works visits had been held this session, but a series of works visits in Belgium at the end of May had been arranged by Mr. Barrington Hooper, who had undertaken the onerous task of fixing up this whole trip to Brussels and Liége, and it was a pleasure to which many were now looking forward.

The two Sections at Ipswich and Slough had both had most successful sessions with good attendances at all their functions, and he paid tribute to their respective hon. secretaries, Mr. A. M. Sumner and Mr. E. Raybould, for their hard work. He also thanked Mr. Harwood Brown, who looks after the attendance register at meetings, and Mr. Ellis, who operated the lantern quietly and efficiently in the dark.

When the report had been adopted, the Branch-President, on behalf of the Council, presented to Mr. A. R. Purchase a cigarette box, to mark the completion of 25 years during which he had reported the meetings of the Branch. Mr. Purchase acknowledged the gift and the kindly thought which had prompted the Council to make it and recalled his very happy association with the Branch and the Institute over those many years.

Election of Officers, Etc.

The meeting then elected its officers for the forthcoming session:—

President, Mr. E. M. Currie; *Vice-Presidents*, Mr. P. D. Pincott and Mr. G. W. Rousham; *Hon. Secretary* and *Treasurer*, Mr. F. Arnold Wilson.

Members of Council: Mr. L. W. Sanders, Mr. W. G. Mochrie, Mr. B. Levy and Mr. F. E. Tibbenham. *Representative on the Technical Council of the Institute:* Mr. Frank Hudson. *Honorary Auditors:* Mr. V. Delport and Mr. C. Cleaver. *Delegates to General Council:* Mr. C. H. Kain, Mr. A. C. Turner, Mr. V. Delport, Mr. P. D. Pincott, Mr. G. R. Webster and Mr. H. W. Lockwood.

The CHAIRMAN extended a welcome to Mr. Braidwood, a member of the Institute, who had recently visited Belgium, where he had met Mr. Deprez, President of the Belgian Foundrymen's Association, from whom he had a message to convey pertaining to the forthcoming visit to Belgium by some 40 members of the London Branch.

MR. BRAIDWOOD said that, when in Belgium recently, he had visited a number of foundries and had presented a Paper to the Association Technique de Fonderie at Brussels and Liége. The President and the general secretary of that Association had asked him to convey the following message:—"The foundrymen in Belgium are eargerly anticipating the visit of the members of the London Branch of the Institute of British Foundrymen and will do everything possible to make the visit a complete success, both technically and socially."

Mr. Braidwood added that, having recently experienced Belgian kindness and hospitality, he could assure those who were fortunate enough to take part in the visit in May that they would find it most enjoyable and memorable.

MR. E. BROWN asked if any member of the Branch would agree to serve as steward, a position which he had held for six years. An appeal was made by Mr. Currie that Mr. Brown should continue to serve as steward, and Mr. G. C. Pierce volunteered to assist in the duties.

Short Paper Competition

The usual practice was followed on this occasion of submitting short Papers for competition. Of the Papers submitted, four had been selected for submission to the meeting. These were read, and the meeting judged them in the following order of merit:—Mr. Murray, Mr. Michael, Mr. Whipp, and Mr. Haigh. Prizes were presented to the first three.

Col. Grose, who has left Johannesburg for Australia has resigned the presidency of the South African Branch. In his stead, Mr. J. H. West has been appointed with Mr. H. Tenbis as vice-president.

Engineering Properties of Heat-treated Cast-Irons*

By J. S. Vanick

There is one important difference between castings of cast iron and steel. Practically all steel castings must be heat-treated to break up a weak and brittle, coarsely crystalline structure that forms during solidification. Cast iron, in contrast, precipitates graphite during solidification. This precipitation obscures and apparently obstructs the progress of crystallisation such as occurs in steels, so that the amount and disposition of this graphite formed at the birth of the casting largely determines the toughness and the strength characteristics, while the composition and rate of cooling establish the final strength and toughness. This is a fundamental reason why cast iron, properly alloyed, develops excellent properties in the "as cast" form, whereas cast steel, especially if alloyed, should be heat-treated to develop best results.

Unless the foundryman delivers heat-treated castings to the prescribed physical property specifications, it is important for the heat-treater to know all about the composition of his material to achieve the best results. This is especially important for the heat-treatment of production lots of castings where a close adherence to specifications is necessary so that a standardised heat-treatment may be depended upon to yield uniformly desirable results. The most common heat-treatment procedures in practice to-day are shown in Fig. 1.

Stress Relief Annealing

Stress relief annealing is defined as the process of reducing internal stresses in a casting by heating it to a temperature below the transformation range and holding for a proper time at that temperature, followed by slow cooling. When properly applied, the treatment does not alter the general engineering properties of the material appreciably. It serves mainly to apply a controlled, slow, uniform rate of cooling to castings which by their design, shape, section, composition and method of moulding and gating, have cooled in the mould at irregular rates. For such castings, heating to 480 to 620 deg. C. serves to relieve any local concentration of stress. In more common cases, the treatment is applied to achieve dimensional stability where accuracy in dimensions is a required property.

Castings should be heated slowly (usually at a rate not exceeding 55 deg. C. per hr.). Large castings of irregular shape and section must be handled carefully to make sure that the heat penetrates uniformly into heavy sections and box-shaped pockets. Holding time at the annealing temperature need not exceed one hour per inch of section, unless a lower temperature, in the 425 to 450 deg. C. range is used, where an additional 5 to 6 hrs. may be added to compensate for the slower rate of stress relief, as indicated in Table I.

Most castings are used in the "as-cast" condition. Foundrymen have applied practices which reduce internal stresses to a negligible factor. Designers have co-operated by providing uniformity and symmetry in sections.

TABLE I.—*Summary of Stress Relief Anneal Treatments*

Heating Rate per Hr.-Max. in deg. C.	Stress Relief	Temperatures in deg. C.	Holding Time per Inch of Thickness	Maximum Cooling Rate in deg. C. per Hour
110	Slow, low temp. anneal	425 to 480	1 hr. + 5*	55
110	Typical for soft, high silicon irons	480 to 565	1–2 hrs.	55
110	Typical for high strength irons	565 to 620	½–1 hr.	55

* Viz., for 4-in. section; total time = 9 hr.

Many large castings of heavy section cool slowly and uniformly in the moulds and do not retain enough residual stress to require an anneal. The frames, beds and parts of high precision machinery may be stress-relief annealed to be assured of permanence in accuracy. Large, irregular-shaped castings which are heated in service and must retain dimensional accuracy are usually stress-relief annealed. Steam turbine housings are a typical illustration. Auto brake-drums and clutch plates which become heated in service must be free from stresses or be stress-relief annealed; otherwise, eccentricity may occur. Engine castings, such as cylinder heads, blocks, liners, pistons, etc., may require annealing, depending upon design and foundry practice. In general, unnecessary stress-relief annealing can do no harm, but it will add to the cost of a casting.

Residual Stresses

In some castings, a residual stress is a necessary factor to successful operation. Piston rings are a typical example. Foundrymen and engineers in general have not learned how to introduce and control favourably disposed residual stresses which could be employed to improve the subsequent performance of the equipment. This remains an attractive field for future research.

Annealing has been described as a process involving heating and cooling usually applied to induce softening. The engineering properties of cast iron are altered by annealing to the extent that the strength may be decreased 10 to 30 per cent.; the hardness decreased 30 to 150 units on the Brinell scale, and the structure may contain more graphite and ferrite. Improvements may occur to the extent of a small increase in toughness, better thermal conductivity, greater dimensional stability, and an increase in electrical conductivity with associated electrical properties; also improved enamelling properties.

Softening for Machinability

Production castings which are to be hardened by quenching and tempering are often annealed prior to

E

*From a Paper presented to the Cleveland Meeting of the American Foundrymen's Association. The Author is associated with the International Nickel Company of New York.

Heat-treated Cast Irons

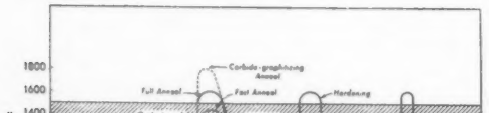


FIG. 1.—HEAT-TREATMENT OF CAST IRON.

machining. Manufacturers equipped with heat-treating facilities frequently find it economical to apply a softening anneal to castings such as cylinder liners which after machining are quenched and tempered to achieve a high hardness. The desirable pattern of the graphite which has formed during the solidification of the casting is not altered appreciably by the anneal. The low temperature anneal (heating within the critical range) is preferred in volume production because of its time-saving advantages. Annealing treatments are illustrated in Fig. 1, and summarised in Table II, covering annealing treatments.

Annealing treatments "A" or "B" (Table II) are most commonly employed. The "A" treatment requires close control, but it does not weaken the castings excessively and does not tie up furnace equipment to the same extent as "B" or "C." Certain automotive castings such as pistons may be annealed to achieve an aggregate improvement in control over uniformity in the machine shop as well as dimensional stability under elevated temperatures. The "B" treatment softens and weakens the iron. The heating time may be prolonged until practically all the carbon has been precipitated as graphite—and a hardness of 120 to 140 Brinell is achieved. A maximum heating rate for small castings would be about 110 deg. C. per hour, a sojourn at the annealing temperature not exceeding 1 hr. per in. of section, and a cooling rate down to 275 deg. C. of less than 55 deg. C. per hr. Certain kinds of hardware, typewriter parts, instrument housings and electrical equipment are typical castings.

Many thin castings produced by permanent (metal) moulds may be processed through the "B" or "C" treatments to achieve toughness or machinability. Centrifugally chill cast pipe and bushings are examples. The high-temperature "C" treatment requires heating to "malleabilising" temperatures to produce machinability in castings containing "chilled iron" structures, or "white iron" in their surfaces or edges.

"Graphitising" the Chill

Heating at 825 to 980 deg. C. (for 1 to 3 hrs. plus 1 hr. per in. of section) will usually breakdown the chill, provided chill stabilising elements such as sulphur, chromium, molybdenum, vanadium, etc., are not present in excess. The anneal "graphitises the chill" and restores machinability.

The cooling rate may be timed to (1) conserve the strength by air cooling from 535 to 825 deg. C.; then furnace cooling at a rate not exceeding 55 deg. C. per hr. to eliminate residual stress, or (2) cool from 825 deg. C. in the furnace or at a rate of less than 55 deg. C. per hr. to obtain a maximum softening comparable to treatment "B" above.

Heat-resisting castings such as engine exhaust manifolds may be alloyed to possess a high resistance to heat. Then they may be annealed as described, for machining, while their alloy content remains to deliver substantial improvement in subsequent performance. In other cases this heat-treatment is mainly used as a reclamation measure upon castings whose composition is out of balance in terms of susceptibility to chill.

Annealing is rarely employed in regular practice because foundrymen are aware of the need to maintain machinability in castings and are skilled in the methods for achieving it. Soft irons can be made with Brinell hardness as low as 140, and used without annealing where strength properties are unimportant and machinability is a dominant factor.

Quenching is described as a process of rapid cooling from an elevated temperature by contact with liquids, gases or solids. In the quenched condition, castings are relatively brittle and weak (Fig. 2), and for most conditions of service it is necessary to toughen them by a reheating process called "tempering."

High Hardness

Tempering is described as the process of reheating a hardened cast iron to a temperature below the transformation temperature range, followed by any desired rate of cooling. The engineering properties obtainable are summarised in Table III, and it is important to point out that the high strength is developed by the high temperature tempering, while the high hardness is developed by the low-temperature tempering (Fig. 2). Most of the discussions on quenching and tempering feature the strength properties that are developed, while practical operations upon castings are mainly directed toward obtaining a high hardness for resistance to wear and abrasion. One reason for this situation rests in the fact that high strengths can be produced by alloying or other means in castings without quenching treat-

TABLE II.—*Annealing Treatments*

Deg. F.	A Low Temp.	B High Temp.	C Chill Elimination
	705 to 760	815 to 870	825 to 980
Holding time—hours per in. of section cooling	1 to 3 slow	½ to 3 slow	1 to 5 slow

ments and with greater security in the case of complicated shapes. High hardness can usually be obtained only by heat-treatments involving quenching.

When cast irons are quenched from above the critical range, they acquire an increase in hardness of from 100 to 300 Brinell units. A soft, weak iron high in graphite content will show a lesser response to this hardening treatment than will a composition that is stronger and harder "as cast." Thus, a soft iron of relatively high carbon content may be hardened from a level of 175 Brinell to approximately 325 Brinell by applying a quenching treatment, while a high strength, lower carbon type may move up in hardness from 220 Brinell to 450 Brinell. With the help of suitable alloys these hardnesses can be increased an additional 100 units to top levels of 500 to 550 Brinell. The common quenching media are air, oil and water. The usual quenching medium for cast iron is an oil bath, because it provides a faster cooling rate than is obtainable in air, and a slow enough rate to avoid temperature stresses and gradients of a magnitude that might cause cracking. Most of the castings that are heat-treated to develop high hardness are quenched in oil from above the critical temperature range.

Holding Time

The usual procedure consists of heating the castings to approximately 840 to 875 deg. C. Preheating in a separate furnace to about 590 deg. C. reduces the risk of cracking due to temperature differentials and cuts down the time of heating at the higher temperature, thus reducing scaling. This procedure is rarely used, and the more common practice consists of heating from a relatively low temperature to the quenching temperature in the same furnace. Castings need to be held only long enough to acquire a uniform temperature, at which time they should be quenched. Tempering should preferably follow immediately after quenching, and for best practice the casting may be at a temperature of 90 to 150 deg. C. at the time it enters the tempering furnace. Castings that are heat-treated for high strength usually possess a higher hardness after heat-treatment than in their "as cast" condition.

Since a casting is expected to possess about the same degree of toughness that it had in the "as cast" condition, it is necessary to acquire this toughness in quenched castings by tempering after quenching. Fig. 2 shows that by tempering in the range of 175 to 260 deg. C. the hardness is not appreciably changed from the quenched condition, while the strength and toughness have been improved to approach their "as cast" levels.

TABLE III.—*Approximate Tensile Strength and Hardness of Heat Treated vs. "As Cast" Irons*

Tensile Strength		Hardness	
"As Cast"	Heat Treated for High Strength	"As Cast"	Heat Treated for High Hardness
29.0	37.9	280	530
25.0	33.4	250	500
19.8	26.7	220	480
13.4	20.1	190	430
8.8	13.4	165	380

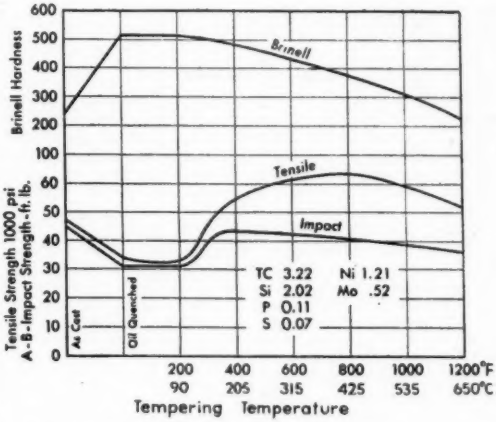


FIG. 2.—INFLUENCE OF THE TEMPERING TEMPERATURE ON THE PROPERTIES OF NI-MO CAST IRON.

High Abrasion Resistance

With the alloyed irons, it may be possible to heat to as high as 395 deg. C. and retain a high level of hardness, accompanied by a further improvement in strength over the "as cast" product. Castings requiring a high resistance to abrasion which is met by a suitable microstructure at a hardness usually above 400 Brinell, are tempered after quenching by reheating them in the low temperature range of 150 to 425 deg. C. (Fig. 1).

The time at tempering usually does not exceed 1 hr. per in. of section after the casting has acquired the desired temperature. Castings may be cooled in the furnace after tempering, thus eliminating any risk of acquiring additional internal stress due to irregular cooling. However, air cooling from the low temperatures to which castings are heated on tempering, rarely produces a cooling rate that is rapid enough to cause distortion or difficulties due to internal stress. Engine cylinder liners are the most common type of casting processed through the quenching and tempering heat-treatment. Others are cams, gears, rollers, dies, polishing and grinding equipment, hardware, and numerous small machinery parts.

The cooling rate in air quenching is usually so slow that only very thin castings are successfully treated by this means, and then only if alloys which retard the transformations are present in adequate amounts. Heavy sectioned castings such as dies may similarly be air cooled to acquire some hardening, and because of the slow rate of heat dissipation, require much larger proportions of alloys in their composition.

Heat-treated Cast Irons

Water Quenching

Quenching in water imparts a cooling rate to cast iron which is too drastic in most cases for the castings to survive successfully the stresses raised in their surfaces by the difference in temperature between surface and underlying metal and the limited toughness of the base metal itself. Therefore, water quenching is rarely practised.

There are special heat-treatments such as flame hardening and induction hardening where the skin of a casting is locally heated to a depth usually not exceeding 0.125 in. and quenched by a water spray immediately following the heating operation. Most of these castings are not subsequently tempered, and the successful use of this hardened surface is made possible through the shallow zone that has been treated and the absorption of the accompanying stresses by the tougher, unheated, underlying metal.

The local application of heat by the flame hardening or induction hardening processes involves close attention to mechanical details and conditions of surface in order that the heat flow into the casting may be uniformly controlled. The procedure is limited to applications which possess contours, dimensions, and hardness requirements that are satisfied by a local and shallow hardening of accessible surfaces capable of absorbing the stresses accompanying rapid heating and cooling.

Apparently the properties of the water-quenched zone are similar to those prevailing in quenched material prior to tempering. Typical castings which are heat-treated in this manner are the wearing surfaces of lathe beds, certain gears and cams, rollers, plungers, cylinder liners, etc. These surface-hardened castings are ordinarily used under conditions of loading in which surface pressures are relatively light and the need for a hard, strong underbody does not exist.

High Strength

It is possible to add 4 to 10 tons per sq. in. additional to the strength of a cast iron that has been quenched in oil and tempered (Fig. 2). Tempering after quenching to produce a high strength consists of reheating the quenched castings to a temperature of 315 to 535 deg. C. Most cast irons acquire their maximum strength with this tempering treatment which leaves them some 20 to 100 Brinell units harder than they were in the "as cast" condition.

If the tempering treatment after quenching is carried out to restore the "as cast" hardness, it is usually found that the "as cast" strength is restored and no improvement from heat-treating is obtained. Consequently, the machinability of these irons that have been heat-treated for high strength is inferior to their machinability in the "as cast" condition. The advantages of the treatment rest in the possibility that machining operations may be performed on the softer "as cast" product, after which the stronger and harder castings can be completed by minor machining operations.

Little Change in Impact Strength

The impact strength of a cast iron is not appreciably changed by heat-treatment, except in the poorer grades of iron where a low strength and a low combined carbon content exist in the "as cast" condition. In general, the impact resistance is less after quenching and tempering than existed in the original "as cast" condition. Any expectation of an increased impact resistance should be carefully investigated. The modulus of elasticity is similarly unchanged or not improved by the quenching and tempering type of heat-treatment.

A special type of heat-treatment, limited in its application to castings that can be quenched in a hot salt or lead bath, has been used where a combination of hardness and toughness produces a desirable wear resisting structure. This is called a "hot quenching treatment," which treatment with the above explanation adequately defines the process.

In practice, castings of suitable composition are quenched from above the critical range into a bath at a temperature of 230 to 425 deg. C. and held for sufficient time to obtain the desired change in structure. Usually 2 to 5 hrs. in the quenching bath is sufficient, but longer intervals have been tested out experimentally. The resulting castings possess a hardness in the range of 280 to 380 Brinell, and for their hardness level they possess a higher degree of toughness than occurs in castings that have been cold quenched and tempered to the same hardness value.

Toughness tests as measured by the deflection or A.B.[1] impact test indicate that these irons are much tougher than companion pieces that have been hardened by quenching and tempering in the usual way. Bartholomew[2] reports that at the same hardness as quenched and tempered castings, the hot quenched castings are able to carry twice the load for the same degree of wear, or, conversely, carry the same load two or three times as long. The operation has been limited to cams, gears and similar heat-treatable castings whose service requires of them a high resistance to wear.

REFERENCES.

1 Arbitration bar specimens 1.125 in. dia. by 8 in. long broken on 6 in. span in the Charpy test, or arbitration bar specimens 1.125 in. dia. by 3 in. above supports in the Izod test.

2 Bartholomew, E. L., "Gray Cast Iron," *The Iron Age*, August 1, 1940, pp. 52-54.

In order to focus attention on the need for augmenting the country's power resources, Davey, Paxman & Company, Limited, of Standard Ironworks, Colchester, held a cocktail party at the Savoy Hotel. By means of illustrated literature they introduced their diesel power units, for the rapid manufacture of which the firm has been granted the highest priority. Because of the existence of this or similar type of plant, quite a number of foundry concerns were able to continue working during the great shut-down. It is the Government's policy to increase the number of privately-owned power plants with the object of reducing the load on the grids.

Three Factors Affecting Industrial Activity

Improved Supplies of Raw Materials Predicted

The "Board of Trade Journal," in a survey of raw material supplies, states that the fuel shortage, accentuated by the temporary transport difficulties consequent upon the severe weather, has added its quota to the complexities of the subject. On the one hand, it has brought about sharp falls in domestic output in most fields; on the other, it has led, in general, to reduced consumption on account of the corresponding dislocation to finished goods industries. A balance between the two effects is hard to strike, but a first distinction can be drawn between basic and intermediate materials. The former, coming as they do largely from abroad, are affected more on the consumption than on the production side and, where not masked by seasonal factors, stocks are tending to rise somewhat; exceptions are provided by domestically produced iron ore and salt. But intermediate materials, being preponderantly from home production, have been severely hit, particularly in such important cases as steel, chemicals, paper, leather and textile yarns.

The "Journal" states that the extent to which shortages of these materials will increase or decrease in intensity compared with other factors must depend upon the balance that is secured between production and consuming resources by future coal supplies. So long as there is any overall fuel shortage, the relative importance of labour and plant capacity as limiting elements in the industrial picture must clearly decline, but until experience of the effects of the "new deal" has been gained, confident assessment of the position of particular materials is not always possible.

The major shortages remain severe. Timber, paper, steel, lead and various other materials will continue to be in quite inadequate supply for a long time to come.

The shortage of steel is still acute: for a time, the "Journal" states, the ordinary consumer will feel the effect both of the loss of production due to the fuel crisis and of the priority recently accorded to certain items of basic industrial equipment, *i.e.*, equipment for electricity generation, mining, gas undertakings, coal-oil conversions, railway freight traffic and the industrial development of atomic energy. Crude steel production in the first quarter of 1947 was 2.81 million tons, compared with the 3.43 million tons that would have been yielded by production at the favourable November, 1946, rate of 13.7 million tons a year. Deliveries of finished steel for home use were 2.05 million tons, against 2.32 million tons in the fourth quarter of 1946. It is hoped that during the summer, increased production and higher imports will be achieved.

Serious Lead Shortage

Copper and aluminium are in relatively free supply, although the use of the latter is limited by fabricating capacity. Except for the sharp check in February as a result of the fuel restrictions, consumption of both is well above pre-war levels—three times as much in the case of aluminium—with the tendency still upwards. Zinc is rather less assured, but should suffice for all important needs. Tin remains in world short supply and exportable surpluses of the metal are subject to international allocation. There is some limitation to its usage in the United Kingdom, but most requirements, despite their tendency to rise, should be adequately covered by the output of domestic smelters. The one serious non-ferrous shortage is of lead, and no appreciable improvement is in prospect, notwithstanding the high prices now ruling.

The conclusion reached is that industrial activity at the present time is largely circumscribed by three factors—raw materials, coal and labour—and the supply of each is well below optimum levels. Unlike coal and labour, however, raw materials are not entirely under this country's control and a reliable estimate of the future position must wait on world events. Nevertheless, viewing the problem as a whole, a gradual improvement seems in prospect: home production of raw materials should increase as the coal position is righted; and there are indications that supplies from overseas are getting rather less difficult to obtain.

N.E. Coast Institution of Engineers and Shipbuilders

Mr. H. B. Robin Rowell, chairman of R. & W. Hawthorn, Leslie & Company, Limited, was re-elected president of the North East Coast Institution of Engineers and Shipbuilders at the recent general meeting.

Mr. W. T. Butterwick and Mr. W. E. Loveridge were re-elected and Mr. T. B. Coull, Sir Lawrence Edwards and Mr. C. Stephenson were elected vice-presidents.

Sir Claude Dixon Gibb was re-elected and Prof. A. F. Burstall, Mr. R. Ibison, Lt.-Col. T. Eustace-Smith, and Mr. R. H. Stephenson were elected to serve as ordinary members of the Council. Mr. W. H. Pilmour was re-elected as hon. treasurer.

Siemens Bros.' Capital

Siemens Bros. & Company, Limited, electrical engineers and contractors, propose to increase their capital with the object of providing finance for important developments, extensions, and improvements undertaken during the past year at Woolwich and in the North-East. A meeting has been called to authorise the creation of 1,000,000 4 per cent. cumulative redeemable second preference shares of £1 each to be offered for subscription by the stockholders only at 21s. per share. The consent of the Treasury has been obtained, and application will be made to the London Stock Exchange and the Stock Exchanges of Manchester and Glasgow for permission to deal in the new shares.

NEGOTIATIONS HAVE BEEN OPENED with a firm of engine builders to take over the Shipbuilding Corporation Yard at Southwick, Sunderland.

Heat-treated Cast Irons

Water Quenching

Quenching in water imparts a cooling rate to cast iron which is too drastic in most cases for the castings to survive successfully the stresses raised in their surfaces by the difference in temperature between surface and underlying metal and the limited toughness of the base metal itself. Therefore, water quenching is rarely practised.

There are special heat-treatments such as flame hardening and induction hardening where the skin of a casting is locally heated to a depth usually not exceeding 0.125 in. and quenched by a water spray immediately following the heating operation. Most of these castings are not subsequently tempered, and the successful use of this hardened surface is made possible through the shallow zone that has been treated and the absorption of the accompanying stresses by the tougher, unheated, underlying metal.

The local application of heat by the flame hardening or induction hardening processes involves close attention to mechanical details and conditions of surface in order that the heat flow into the casting may be uniformly controlled. The procedure is limited to applications which possess contours, dimensions, and hardness requirements that are satisfied by a local and shallow hardening of accessible surfaces capable of absorbing the stresses accompanying rapid heating and cooling.

Apparently the properties of the water-quenched zone are similar to those prevailing in quenched material prior to tempering. Typical castings which are heat-treated in this manner are the wearing surfaces of lathe beds, certain gears and cams, rollers, plungers, cylinder liners, etc. These surface-hardened castings are ordinarily used under conditions of loading in which surface pressures are relatively light and the need for a hard, strong underbody does not exist.

High Strength

It is possible to add 4 to 10 tons per sq. in. additional to the strength of a cast iron that has been quenched in oil and tempered (Fig. 2). Tempering after quenching to produce a high strength consists of reheating the quenched castings to a temperature of 315 to 535 deg. C. Most cast irons acquire their maximum strength with this tempering treatment which leaves them some 20 to 100 Brinell units harder than they were in the "as cast" condition.

If the tempering treatment after quenching is carried out to restore the "as cast" hardness, it is usually found that the "as cast" strength is restored and no improvement from heat-treating is obtained. Consequently, the machinability of these irons that have been heat-treated for high strength is inferior to their machinability in the "as cast" condition. The advantages of the treatment rest in the possibility that machining operations may be performed on the softer "as cast" product, after which the stronger and harder castings can be completed by minor machining operations.

Little Change in Impact Strength

The impact strength of a cast iron is not appreciably changed by heat-treatment, except in the poorer grades of iron where a low strength and a low combined carbon content exist in the "as cast" condition. In general, the impact resistance is less after quenching and tempering than existed in the original "as cast" condition. Any expectation of an increased impact resistance should be carefully investigated. The modulus of elasticity is similarly unchanged or not improved by the quenching and tempering type of heat-treatment.

A special type of heat-treatment, limited in its application to castings that can be quenched in a hot salt or lead bath, has been used where a combination of hardness and toughness produces a desirable wear resisting structure. This is called a "hot quenching treatment," which treatment with the above explanation adequately defines the process.

In practice, castings of suitable composition are quenched from above the critical range into a bath at a temperature of 230 to 425 deg. C. and held for sufficient time to obtain the desired change in structure. Usually 2 to 5 hrs. in the quenching bath is sufficient, but longer intervals have been tested out experimentally. The resulting castings possess a hardness in the range of 280 to 380 Brinell, and for their hardness level they possess a higher degree of toughness than occurs in castings that have been cold quenched and tempered to the same hardness value.

Toughness tests as measured by the deflection or A.B.[1] impact test indicate that these irons are much tougher than companion pieces that have been hardened by quenching and tempering in the usual way. Bartholomew[2] reports that at the same hardness as quenched and tempered castings, the hot quenched castings are able to carry twice the load for the same degree of wear, or, conversely, carry the same load two or three times as long. The operation has been limited to cams, gears and similar heat-treatable castings whose service requires of them a high resistance to wear.

REFERENCES.

1 Arbitration bar specimens 1.125 in. dia. by 8 in. long broken on 6 in. span in the Charpy test, or arbitration bar specimens 1.125 in. dia. by 3 in. above supports in the Izod test.

2 Bartholomew, E. L., "Gray Cast Iron," *The Iron Age*, August 1, 1940, pp. 52-54.

In order to focus attention on the need for augmenting the country's power resources, Davey, Paxman & Company, Limited, of Standard Ironworks, Colchester, held a cocktail party at the Savoy Hotel. By means of illustrated literature they introduced their diesel power units, for the rapid manufacture of which the firm has been granted the highest priority. Because of the existence of this or similar type of plant, quite a number of foundry concerns were able to continue working during the great shut-down. It is the Government's policy to increase the number of privately-owned power plants with the object of reducing the load on the grids.

Three Factors Affecting Industrial Activity

Improved Supplies of Raw Materials Predicted

The "Board of Trade Journal," in a survey of raw material supplies, states that the fuel shortage, accentuated by the temporary transport difficulties consequent upon the severe weather, has added its quota to the complexities of the subject. On the one hand, it has brought about sharp falls in domestic output in most fields; on the other, it has led, in general, to reduced consumption on account of the corresponding dislocation to finished goods industries. A balance between the two effects is hard to strike, but a first distinction can be drawn between basic and intermediate materials. The former, coming as they do largely from abroad, are affected more on the consumption than on the production side and, where not masked by seasonal factors, stocks are tending to rise somewhat; exceptions are provided by domestically produced iron ore and salt. But intermediate materials, being preponderantly from home production, have been severely hit, particularly in such important cases as steel, chemicals, paper, leather and textile yarns.

The "Journal" states that the extent to which shortages of these materials will increase or decrease in intensity compared with other factors must depend upon the balance that is secured between production and consuming resources by future coal supplies. So long as there is any overall fuel shortage, the relative importance of labour and plant capacity as limiting elements in the industrial picture must clearly decline, but until experience of the effects of the "new deal" has been gained, confident assessment of the position of particular materials is not always possible.

The major shortages remain severe. Timber, paper, steel, lead and various other materials will continue to be in quite inadequate supply for a long time to come.

The shortage of steel is still acute: for a time, the "Journal" states, the ordinary consumer will feel the effect both of the loss of production due to the fuel crisis and of the priority recently accorded to certain items of basic industrial equipment, *i.e.*, equipment for electricity generation, mining, gas undertakings, coal-oil conversions, railway freight traffic and the industrial development of atomic energy. Crude steel production in the first quarter of 1947 was 2.81 million tons, compared with the 3.43 million tons that would have been yielded by production at the favourable November, 1946, rate of 13.7 million tons a year. Deliveries of finished steel for home use were 2.05 million tons, against 2.32 million tons in the fourth quarter of 1946. It is hoped that during the summer, increased production and higher imports will be achieved.

Serious Lead Shortage

Copper and aluminium are in relatively free supply, although the use of the latter is limited by fabricating capacity. Except for the sharp check in February as a result of the fuel restrictions, consumption of both is well above pre-war levels—three times as much in the case of aluminium—with the tendency still upwards. Zinc is rather less assured, but should suffice for all important needs. Tin remains in world short supply and exportable surpluses of the metal are subject to international allocation. There is some limitation to its usage in the United Kingdom, but most requirements, despite their tendency to rise, should be adequately covered by the output of domestic smelters. The one serious non-ferrous shortage is of lead, and no appreciable improvement is in prospect, notwithstanding the high prices now ruling.

The conclusion reached is that industrial activity at the present time is largely circumscribed by three factors—raw materials, coal and labour—and the supply of each is well below optimum levels. Unlike coal and labour, however, raw materials are not entirely under this country's control and a reliable estimate of the future position must wait on world events. Nevertheless, viewing the problem as a whole, a gradual improvement seems in prospect: home production of raw materials should increase as the coal position is righted; and there are indications that supplies from overseas are getting rather less difficult to obtain.

N.E. Coast Institution of Engineers and Shipbuilders

Mr. H. B. Robin Rowell, chairman of R. & W. Hawthorn, Leslie & Company, Limited, was re-elected president of the North East Coast Institution of Engineers and Shipbuilders at the recent general meeting.

Mr. W. T. Butterwick and Mr. W. E. Loveridge were re-elected and Mr. T. B. Coull, Sir Lawrence Edwards and Mr. C. Stephenson were elected vice-presidents.

Sir Claude Dixon Gibb was re-elected and Prof. A. F. Burstall, Mr. R. Ibison, Lt.-Col. T. Eustace-Smith, and Mr. R. H. Stephenson were elected to serve as ordinary members of the Council. Mr. W. H. Pilmour was re-elected as hon. treasurer.

Siemens Bros.' Capital

Siemens Bros. & Company, Limited, electrical engineers and contractors, propose to increase their capital with the object of providing finance for important developments, extensions, and improvements undertaken during the past year at Woolwich and in the North-East. A meeting has been called to authorise the creation of 1,000,000 4 per cent. cumulative redeemable second preference shares of £1 each to be offered for subscription by the stockholders only at 21s. per share. The consent of the Treasury has been obtained, and application will be made to the London Stock Exchange and the Stock Exchanges of Manchester and Glasgow for permission to deal in the new shares.

NEGOTIATIONS HAVE BEEN OPENED with a firm of engine builders to take over the Shipbuilding Corporation Yard at Southwick, Sunderland.

Personal

MR. B. WASDEN has been appointed a director of the Hallamshire Steel & File Company, Limited.

MR. D. W. BROUGH has been appointed an additional director of the Metal Box Company, Limited.

MR. A. M. WILLIS has been co-opted to the board of the Anti-Attrition Metal Company, Limited.

MAJOR F. W. CUNDIFF has been appointed a director of the National Gas & Oil Engine Company, Limited.

LORD FORRESTER, managing director of Enfield Cables, Limited, is seriously ill at Braga, Northern Portugal, as a result of a recent accident.

SIR GEORGE BINNEY has been elected a director of Tilling-Stevens, Limited, mechanical, electrical and traction engineers, of Maidstone.

MR. L. OULTON has resigned from the board of Francis Morton & Company, Limited, manufacturers of structural steelwork, etc., of Liverpool.

MR. H. E. ARBLASTER, the well-known Australian metallurgist, has been granted the degree of Master of Metallurgical Engineering by the University of Melbourne.

MR. W. S. RICHARDS has been appointed general manager of the heating and air-treatment division of the Brightside Foundry & Engineering Company, Limited.

M. ALOYSES MEIER, formerly general manager of Arbed, the Belgo-Luxemburg iron and steel concern, has been appointed a director and chairman of the company.

MR. S. H. GRIFFITHS, chief metallurgist for the John Thompson Engineering Company, Limited, has been elected chairman of the Wolverhampton branch of the Institute of Welding.

MR. F. C. WHITEHOUSE has been appointed chairman of Armstrong, Stevens & Son, Limited, drop forgers and machinists, etc., of Birmingham and Willenhall, in place of MR. T. NIGHTINGALE, who has retired.

MR. G. H. H. THORNE has been appointed managing director of Dawnays, Limited, structural engineers, of Battersea, London, S.W.11. MR. P. BROOKS becomes assistant managing director of the company.

LT.-COL. HOWARD DEARNS, former Chief Instructor and Assistant Commandant at the Army College, Chisledon, has been appointed education officer on the training and welfare staff of Newton Chambers & Company, Limited, Thorncliffe, near Sheffield.

MR. JAMES FERRIER, of Rankin & Blackmore, Limited, engineers and founders, and MR. P. J. F. WILLIAMSON, of Ferguson Bros. (Port Glasgow), Limited, shipbuilders, etc., have been appointed president and vice-president of Greenock Chamber of Commerce for the ensuing year.

COL. C. R. HODGSON, a director of R. A. Lister & Company, Limited, engineers and ironfounders, of Dursley, Glos., and Blackstone & Company, Limited, manufacturers of Diesel engines, etc., of Stamford, has been awarded the D.S.O. for his wartime services in the South-West Pacific.

MR. ALEXANDER LIGHTBODY has resigned from the post of managing director of Tullos, Limited, Aberdeen, so that he can devote his entire time to the work of C. F. Wilson & Company, Limited, Diesel oil engine makers, of Aberdeen, of which he is also managing director. He retains his seat on the board of the former company, and will be succeeded as managing director by MR. NORMAN ARCHER.

MR. J. W. C. BUTLER has been appointed assistant secretary to the Joint Iron Council, principally for duties in connection with ironfounding matters. For several years he was on the staff of the FOUNDRY TRADE JOURNAL. During the war, he served as a Lieutenant, R.N.V.R., with the Fleet Air Arm, and from 1944-46 was secretary of the Admiralty's Training Devices Committee, in which appointment he made studies of instructional methods and visual training aids. Since his release, Mr. Butler has been assistant editor of our associated journal, *Sheet Metal Industries*.

MR. WILFRED JOHN DAWSON, metallurgical director of Hadfields, Limited, for many years, who has retired from the board on account of ill-health, was closely associated with the late Sir Robert Hadfield for nearly 40 years and assisted him in numerous researches. He took the metallurgical course at the Technical School, Sheffield, under the late Prof. J. O. Arnold, and at the age of 18 was awarded the Associateship in Metallurgy. After serving three years in the laboratory of Henry Bessemer & Company, Limited, he joined the laboratory staff of Hadfields, Limited, Hecla Works, Sheffield. Shortly afterwards Mr. Dawson was put in charge of the steelmaking department of the Hecla Works and for nearly half a century he has been closely identified with all metallurgical developments of that company. During the 1914-18 war he was appointed manager of the metallurgical department and joined the board of directors in 1919. Mr. Dawson served as chairman of the Technical Advisory Committee of the Special and Alloy Steels Committee (Steel Control of the Ministry of Supply) during the last war and also as a member of the Metallurgy Committee of the Advisory Council on Scientific Research and Technical Development and the Iron and Steel Technical Committee (Ministry of Supply). He was the chairman of Tanks Cast Armour Committee from its foundation and a member of the Tanks Wrought Armour and Aircraft Armour Committees. Mr. Dawson is a member of the Council of the British Iron and Steel Research Association, vice-president of the Iron and Steel Institute, a member of the general board of the National Physical Laboratory, a member of the Engineering Divisional Council and the Iron and Steel Industry Committee of the British Standards Institution, and a founder Fellow of the Institution of Metallurgists, of which he was a member of the original Council. He has served as a member of many other committees. Mr. Dawson was awarded the E. J. Fox gold medal of the Institute of British Foundrymen for 1940 in recognition of his work as chairman of the Steel Castings Research Committee.

Save Fuel
IN YOUR CUPOLAS
BY USING
STANTON
HOLWELL
or RIXONS
SAND-LESS
MACHINE CAST
PIG IRON
THE STANTON IRONWORKS COMPANY
LIMITED
NEAR NOTTINGHAM

News in Brief

APPROXIMATELY 70,000 TONS of steel production was lost in Sheffield during February and March by the fuel shortage, said Mr. Leonard, Parliamentary Secretary to the Ministry of Supply, replying to a question in the House of Commons.

IN THE METAL, engineering and shipbuilding industries, 124,000 working days were lost by 32,600 workers involved in 25 disputes during February, compared with 118,000 working days, 51,700 workers and 37 disputes during January, according to figures published in the "Ministry of Labour Gazette."

DETAILS ARE EXPECTED to be announced shortly of the merger between the British Piston Ring Company, Limited, Hepworth & Grandage, Limited, and Wellworthy Piston Rings, Limited, by means of a holding company. Negotiations are stated to be well advanced. Combined capital of the companies is £870,000.

THE MINISTER OF SUPPLY told Mr. Erroll in the House of Commons recently that he would discuss the application of the statistical method of inspection developed during the war, known as "quality control," with the Engineering Advisory Council, with a view to ensuring its adoption for peace-time engineering products.

THE ANNUAL REPORT of the directors of the Hoffmann Manufacturing Company, Limited, states that the reorganisation and re-equipment of the factories are at present being financed by the company's bankers. If later it is considered advisable to put this finance on a permanent basis, the directors will bring their suggestions to the shareholders.

THIRTEEN ITALIAN skilled foundry workers who were to have started work in Manchester and Salford foundries are being placed in other districts, as local foundrymen refused to work alongside them because of the alleged black-listing of Mr. A. Arnison, president of the Salford branch of the Amalgamated Union of Foundry Workers, by local employers.

BRITISH MANUFACTURERS and importers of £10,000,000 worth of Diesel generators have agreed to accept Government guidance in the sale and placing of their products because of the shortage of electric generating plant in this country and the necessity for ensuring that Diesel generating sets are sold only to purchasers who will make the fullest use of them.

THE FIRST OF A SERIES of "design weeks," which, it was announced at the close of the "Britain Can Make It" exhibition, would be held in the leading industrial centres, will be at Newcastle-upon-Tyne from July 7 to 12, inclusive. Other fixtures include those for Manchester in September, Birmingham in November, Cardiff in January, 1948, and Bradford in March, 1948.

THE BRITISH NON-FERROUS METALS RESEARCH ASSOCIATION, of Euston Street, London, N.W.1, has issued a series of helpful suggestions designed to mitigate as far as possible the present acute shortage of chromic acid. Readers harassed by this shortage should write to the Association, mentioning the JOURNAL; they will, we are sure, receive a copy of the document in question.

THE HOLLOW-WARE WAGES COUNCIL (GREAT BRITAIN) intends to submit to the Minister of Labour and National Service proposals for the revocation of the Hollow-ware Wages Council (Great Britain) Wages Regulation (No. 2) Order, 1946, and for the fixing of specified statutory minimum remuneration in substitution for the present statutory minimum remuneration.

MANAGEMENT WAS NOT a right to be demanded but a distinction to be earned and a responsibility to be borne, said Sir Harold Kenward, of the Dunlop Rubber Company, at the industrial session of the Rotary International Conference. He described as an "irritating development" the modern tendency of those who had never managed anything to insist upon what was called "a share in the management."

MR. BEVAN, Minister of Health, speaking at Blaenau Festiniog recently, said that what the Socialist Government had done in the field of nationalisation so far had been fairly orthodox. But when the Government set about nationalising the steel industry, then "the band would begin to play." There would be suggestions made that some parts of the industry were efficient and satisfactory and so should be left alone, but he was opposed to the Government taking over the cripples and leaving the good things in private ownership.

Price of Quicksilver Reduced

The London ex-warehouse price of quicksilver has been reduced from £20 10s.-£21 to £17 5s. per flask; the price for shipment, c.i.f. United Kingdom, is now £16 12s. 6d., compared with the previous level of £20 6s. per flask.

The price changes followed a report that Mercurio Europeo, the Spanish-Italian group, had decided to reduce their general export quotation from $79.5 to $65 per flask, f.o.b. Spanish-Italian ports, equivalent to about £16 3s. per flask. The substantial cut in quotations, it is thought, is intended primarily to sterilise Mexican competition, particularly to the United States and this country. The combine's new sales policy is significant in that its implementation more or less coincides with their approach to the Mexican producers inviting them to become a member of the group.

Gauge and Tool Advisory Council

The Minister of Supply has appointed Sir Charles McLaren as the official chairman of the Gauge and Tool Advisory Council in succession to Mr. S. F. Steward, who has resigned in order to be free to devote full time to his business interests. Sir Charles is Director-General of Ordnance Factories with the Ministry of Supply, a post he assumed in 1940. Mr. Steward, who was formerly Director-General of Machine Tools in the Ministry, has been giving part-time service to the Government as chairman of two advisory councils. He resigned the chairmanship of the Machine Tool Advisory Council last month.

"Is your fuel cut as serious as it looks?

My own looked like a knock-out, but I softened the blow"

That's interesting. Tell me more!

A friend showed me a copy of "Fuel Efficiency News"; it's a monthly pamphlet of the Ministry of Fuel and Power. It described the free technical advisory service of the Ministry, so I decided to try it out and I rang up the Regional Fuel Office. A Fuel Engineer came to see me the very next day.

What sort of advice did he give?

First he told me how best to use the classes of fuel I am now getting. Then we went round the plant and he suggested a number of ways in which I could cut down my fuel needs. I soon managed to carry out the suggestions that needed no outside assistance, and plans are being prepared by my consultant for the rest—plans that will undoubtedly enable me to save on my present fuel allocation.

But won't that take a long time?

Not really. As a matter of fact, my engineer had been pressing me to adopt some of the ideas for quite a while. I wish now that I had followed his advice in the first place.

ISSUED BY THE MINISTRY OF FUEL AND POWER

HOW THE FUEL EFFICIENCY SERVICE CAN HELP

1 It can quickly send to your works a Fuel Engineer—a specialist in your particular industry and its problems—to give a free, fair and objective opinion on your present methods of using fuel and steam. Any recommendations he makes are yours to accept in entirety or to modify, just as your judgment dictates. You simply telephone the Regional Fuel Office and ask for a Fuel Engineer naming, if possible, your particular requirements.

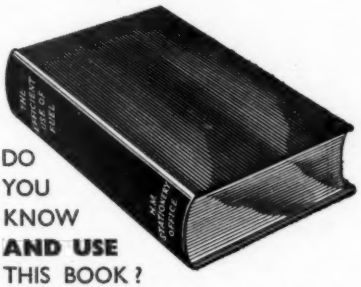
2 It issues helpful publications—many of them on the problems of individual industries—special bulletins, leaflets, posters, etc. Ask to see "Fuel Efficiency News"

3 It arranges free practical training of boiler-house personnel at your factory or in special instructional classes, with award of proficiency certificates. This training, given by experienced stoker demonstrators, has proved to be an excellent service.

4 It arranges evening classes and lectures; and films for showing to executives, boiler attendants and staff.

5 It gives advice and personal assistance in the formation of joint fuel efficiency committees at works.

6 It will arrange showings, or loan of, film-strips, slides and many helpful fuel efficiency films.



DO YOU KNOW **AND USE** THIS BOOK?

The 807 pages of "The Efficient Use of Fuel" contain information drawn from vast experience accumulated by technicians, lecturers and investigators, who have had direct access to tens of thousands of industrial plants, and have observed an immense amount of experimental work and practical achievement in every kind of establishment. With 34 chapters and 303 illustrations it is the most complete of all text books on fuel utilisation. Published by H.M. Stationery Office at 12/6 net., 13/- post free.

Obituary

MR. CHARLES STANLEY GRAHAM, chief metallurgical chemist at the Normanby Park Works, Scunthorpe, of John Lysaght, Limited, has died in tragic circumstances.

MR. EDGAR HENRY BENCE, who has died at the age of 70, was managing director of Ham, Baker & Company, Limited, engineers and founders, of Langley Green, Worcs.

MR. W. GREENWOOD, managing director of E. Greenwood & Company (Brassfounders), Limited, Elland, Yorks, has died at the age of 54. He was a member of the Executive Committee of the National Brassfoundry Association.

SIR ERNEST JARDINE, Bt., whose death occurred recently, was governing director of John Jardine, Limited, manufacturers of power transmission appliances, founders, etc., of Nottingham. He was 87 years of age. Sir Ernest, who was on the board of a number of companies, represented the former East Somerset constituency in Parliament from 1910-18 as a Liberal Unionist member. He was High Sheriff of Nottinghamshire in 1928.

Stock and Sales of Non-ferrous Scrap

The Ministry of Supply announces that the stock of non-ferrous scrap on charge on March 31 was 47,842 tons, made up as follows:—Muffled S.A.A., 908 tons; lead and lead alloy, 1,085; copper and copper alloy, 17,571; zinc and zinc alloy, 6,972; other grades (including mixed metals from cancelled contracts, Admiralty scrap, Army scrap and M.O.W. scrap), 21,306 tons.

Sales for the two months' period February to March, amounted to 10,907 tons (approximate value £655,000). The analysis was as follows:—Q.F. and muffled S.A.A., 2,605 tons; copper and copper alloy, 750; lead and lead alloy, 1,072; other grades (including zinc and zinc alloy), 6,480 tons.

Material put out to tender during the period amounted to 6,074 tons, of which 3,994 tons were lead. During the February-March period 11,904 tons were invoiced, the value being £653,951.

Steel Company of Wales

The registration has been announced of the Steel Company of Wales with a nominal capital of £40,000,000 and borrowing powers of a similar amount. The company has been formed to construct and operate the new steelworks, continuous strip mills, and tinplate mills in South Wales.

Pending the appointment of executive officers, the management of the company will be vested in an executive committee of the board. Mr. E. Julian Pode will be chairman of the committee, Capt. H. Leighton Davies, deputy chairman, and the other members will be Mr. W. F. Cartwright, Mr. T. O. Lewis, and Mr. E. C. Lysaght.

Contracts Open

Any date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Bathavon, May 23—Construction of about 8,000 yds. of 5-in., 4-in. and 3-in. dia. spun-iron water mains, etc., for the Rural District Council. Willcox, Raikes & Marshall, engineers, 33, Great Charles Street, Birmingham. (Fee £5 5s., returnable.)

Belper, May 23—Provision and laying of about 5,200 yds. of 6-in., 4,000 yds. of 5-in., 12,000 yds. of 4-in. and 100 yds. of 3-in. iron pipes, etc., for the Rural District Council. Elliott & Brown, consulting engineers, Stanley House, Pelham Road, Nottingham. (Fee £3 3s., returnable.)

Birkenhead, May 29—Wrought-iron tubes and fittings; cast-iron pipes and specials; brasswork; gas and meter fittings; iron and steel; gas meters, tinware, etc., for the Town Council. The Gas Engineer, Gas Offices, Hind Street, Birkenhead.

Middlesbrough, May 27—Cast-iron surface boxes, for the Tees Valley Water Board. Mr. T. S. R. Winter, engineer and general manager, Water Board Offices, Corporation Road, Middlesbrough.

Middlesbrough, June 24—Contract No. 12: Provision and erection of an electrically-driven centrifugal pumping plant, for the Tees Valley Water Board. Mr. T. S. R. Winter, manager, Tees Valley Water Board, Corporation Road, Middlesbrough. (Fee £5 5s., returnable.)

Southampton, May 30—Cast-iron direction posts, flag-type direction signs, etc., for the County Council. Mr. A. C. Hughes, county surveyor, The Castle, Winchester, Hants.

Recent Wills

ROBERTS, J. N., chief buyer of the Carborundum Company, Limited £5,012

WOOD, WILLIS, a local director of Thos. W. Ward, Limited, Sheffield £3,724

HAYTER, LORD, a managing director of Chubb & Sons Lock & Safe Company, Limited £82,366

GARDNER, F. C., chairman of Wm. Gardner & Sons (Gloucester), Limited, flour milling engineers, etc. £117,734

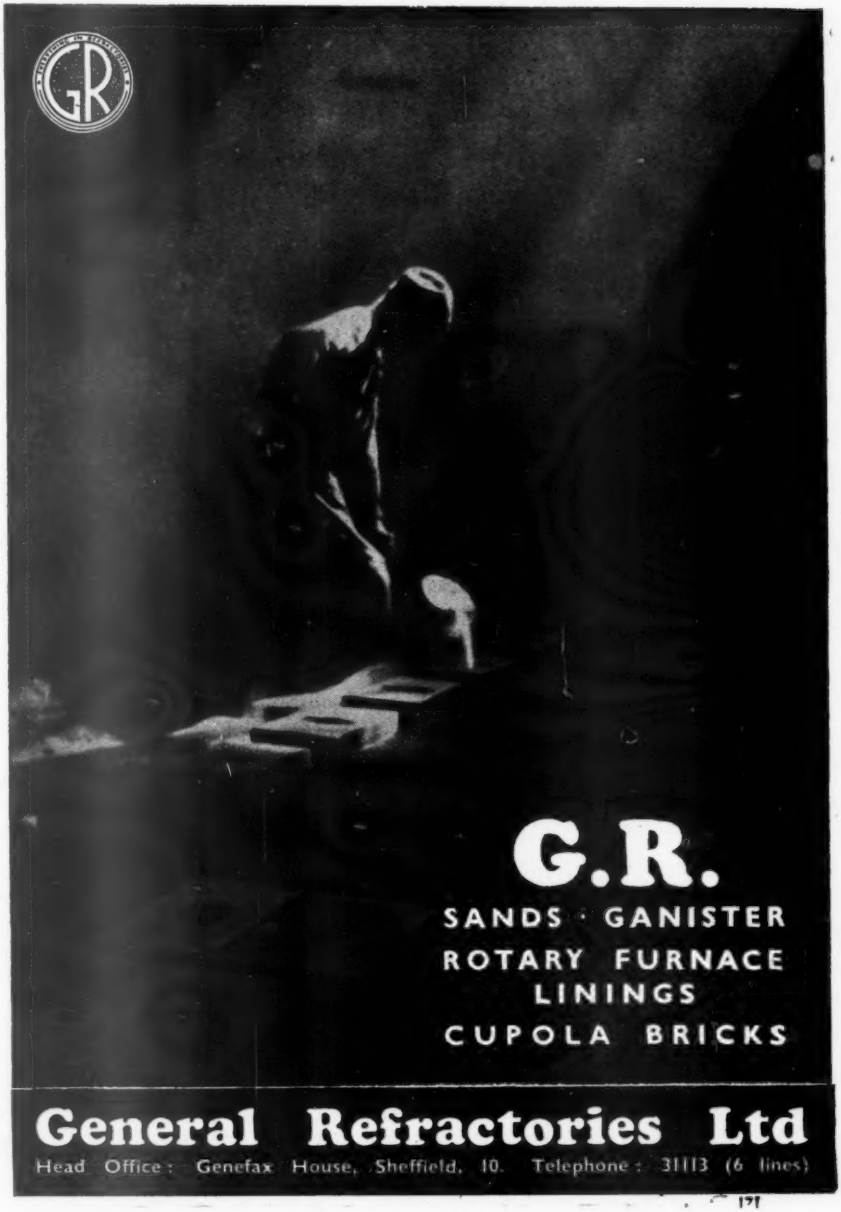
HAMILTON, SIR C. G. C., chairman of the Expanded Metal Company, Limited, and a director of Drake & Gorham, Limited £69,316

MCEWEN, SAMUEL, a director of Mitchell Engineering, Limited, and president of the Combustion Appliance Makers' Association £11,081

BLAKE, R. G., a director of the Staveley Coal & Iron Company, Limited, and Thomas Turton & Sons, Limited, steelmakers, etc., of Sheffield £79,797

CHORLTON, A. E. L., chairman of Edward Wood & Company, Limited, Lancashire Dynamo & Crypto, Limited, and a director of Kendall & Gent (1920), Limited, Smethwick Drop Forgings, Limited, Smethwick Stamping Company, Limited, and other companies £45,057

MR. RICHARD WALTER NOAKES, managing director of R. W. Noakes & Son (Metal Workers), Limited, of Leicester, died recently. He was 66 years of age.


G.R.
SANDS · GANISTER
ROTARY FURNACE
LININGS
CUPOLA BRICKS
General Refractories Ltd
Head Office: Genefax House, Sheffield, 10. Telephone: 31113 (6 lines)

Company News

(Figures for previous year in brackets.)

Lake & Elliot—Interim dividend of 5% (4%).

Asa Lees (Holdings)—Dividend of 20% (same).

Peter Brotherhood—Interim dividend of 8% (same).

Richard Hill & Company—Interim dividend of 5% (3%).

E. G. Brown & Company—Interim dividend of 10% (same).

Herbert Morris—Interim dividend of 5%, tax free (same).

Hopkinsons—Final dividend of 17½% (15%), making 22½% (20%).

Robey & Company—Dividend of 10% (same and jubilee bonus of 10%).

Grayson, Rollo & Clover Docks—Dividend of 10% (same and Victory bonus of 5%).

Babcock & Wilcox—Final dividend of 7% (6%) and bonus of 3% (2½%), making 15% (12½%).

Rawlplug Company—Final dividend of 30% (same) and bonus of 5% (nil), making 45% (40%).

Sturtevant Engineering Company—Final dividend of 11% (9½%), tax free, making 16½% (14½%), tax free.

British Thermostat Company—Final dividend of 11% (same) and bonus of 5% (nil), making 23½% (18½%).

W. Canning & Company—Final dividend of 5% (same) and bonus of 17½% (12½%), making 27½% (22½%).

International Twist Drill Company—Final dividend of 25%, making 125%, less tax, on increased capital (30%, tax free).

London Electric Wire Company & Smiths—Final dividend of 5½% (same) and bonus of 2½% (nil), making 10% (7½%).

Aluminium Plant & Vessel Company—Final dividend of 33⅓%, less tax (20%, tax free), making 50%, less tax (25%, tax free).

G. & J. Weir—Final dividend of 30%, less tax (19%, less tax), making 40%, less tax; the interim dividend of 15% for the previous year was tax free.

Sangamo Weston—Net profit for 1946, after depreciation, taxation, etc., £47,001 (£2,493); dividend of 17½% (15%); forward, £174,444 (£142,902).

Prior Stokers—Profit for 1946, £12,040 (£2,346); to income tax, £5,685 (£803); dividend of 10% (6%); general reserve, £2,500 (nil); forward, £3,465 (£2,091).

Smith & McLean—Net profit for 1946, £74,780 (£50,573); reserve not required, £3,223 (nil); to reserve, £10,000 (same): dividend of 11% (same) and bonus of 9% (4%); forward, £162,720 (£120,154).

Sanbra—Net profit for 1946, after depreciation, etc., £126,936 (£58,733); to tax, £92,000 (£50.000); final dividend of 12½%, making 17½% (12½%); to general reserve, £10,000 (nil); taxation reserve, £11,000 (nil); forward, £11,000 (£7,802).

Plessey Company—Interim dividend of 10% (15%). The directors state that the reduction is made merely as a precautionary measure until they are able to assess more fully the fuel situation and its effect on the supply of raw materials.

Minerals Separation—Profit for 1946, £125,934 (£98,946); to tax, £66,345 (£44,500); written off purchase of patents, £49,650 (£50,000); dividend of 40% (35%); net directors' additional remuneration, £5,297 (£4,195); forward, £83,040 (£122,398).

Darlington Wire Mills—Net profit for 1946, after charging £13,099 (£12,657) for tax reserve and £1,300 (£1,304) for directors' fees, £16,183 (£16,951); final dividend of 17½% (22½%), tax free, making 25% (30%), tax free; forward, £80,497 (£78,065).

Halesowen Steel Company—Net profit for 1946, including £17,000 (£29,000) E.P.T. recoverable, and after charging £22,000 (£23,000) for taxation, £24,567 (£26,096); general reserve, £10,000 (£15,000); dividend of 20% (same); forward, £24,409 (£21,255).

Quirk, Barton & Company—Profit for 1946, £34,258 (£11,060); to taxation, £18,400 (£5,213); depreciation, £1,750 (same); provision for possible loss on unexecuted contracts, £6,000 (nil); final dividend of 6%, making 8½% (same) and special bonus of 4% (nil); forward, £18,814 (£18,501).

British Oxygen Company—Net profit for 1946, after providing for E.P.T., deducting £500,000 (£537,557) for U.K. income tax, and crediting £150,000 (nil) adjustment of E.P.T. in respect of earlier years, £668,858 (£520,587); final dividend of 12% (8%), making 20% (same); to general reserve, £200,818 (£100,000); forward, £100,389 (£80,445).

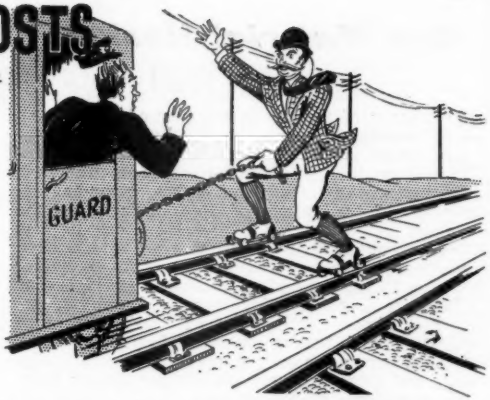
Alexander, Fergusson & Company—Profit for 1946, after taxation and contingencies, £26,775 (£16,700); revenue from property and investments, £1,300 (£1,242); transfer fees, £4 (£5); to depreciation, £5,000 (£4,500); preference dividend, £1,925 (£1,750); dividend of 24% (16%), tax free, on the "A" and "B" ordinary shares; forward, £20,547 (£16,193).

Vosper—Net trading profit for the year ended August 31, £47,803 (£55,767); to bank interest, £11,318 (£16,455); depreciation, £10,562 (£11,751); directors' fees, £1,900 (same); other fees, £898 (£926); taxation, £13,701 (£14,875); provision for contingencies, nil (£3,500); ordinary and deferred dividend of 10% (same); forward, £22,505 (£19,956).

Ransomes, Sims & Jefferies—Net profit for 1946, after providing for taxation and transferring £69,410 (nil) to stock contingencies account, £84,302 (£57,534); to pensions, £25,000 (£15,000); post-war contingencies, £30,000 (£15,000 to general reserve); dividend of 7½% (same), the new ordinary stock ranking for one-third of this rate; forward, £63,323 (£64,133). It is stated that owing to the incidence of E.P.T. and the change in the E.P.T. rate, the net profit does not provide a valid comparison with 1945.

CUTTING DOWN COSTS *isn't always easy, but*

hundreds of satisfied users have found that STERNOCORE enables foundry castings to be made to closer limits. This gives more accurate cores, easier working, reduced fettling, quicker drying and faster machine shop production. In short—lower true costs.



** Full details and free samples will be gladly sent you on request.*

Sternocore

HIGH EFFICIENCY CORE OILS, CREAMS & COMPOUNDS

PRODUCTS OF STERNOL LIMITED, LONDON

STERNOL LTD. : FINSBURY SQUARE : LONDON E.C.2. : Phone : MONarch 3871-2-3-4-5 : Telegrams : "Sternoline, Phone, London."
Also at BRADFORD and GLASGOW

TELEGRAMS :
HOPE WORKS, DUDLEY.
STEVE, WESDO, LONDON.

VAUGHANS (Hope Works) Ltd.
— DUDLEY —
FOUNDRY REQUISITES

TELEPHONE :
DUDLEY 2411 (TWO LINES)
LONDON, MAYFAIR 5414.

Raw Material Markets

Iron and Steel

The scarcity of pig-iron is a matter of greater concern to foundrymen than the relatively small price changes which are now operative. Prior to the fuel crisis, the production of high-phosphorus iron was hardly sufficient to satisfy the rapidly expanding requirements of the makers of light castings, and the subsequent contraction of blast-furnace outputs has involved grave industrial embarrassments which have not yet been overcome. Consumers, without exception, are buying to the limit of their licensed tonnages, but full deliveries cannot be relied upon and foundry operations must almost certainly be restricted until more liberal supplies of foundry pig-iron and scrap are forthcoming. Other grades of iron are also in more active request; and users are only permitted to cover their immediately visible needs.

The steel-melting shops are still operating at a level well below full capacity, and no substantial improvement is anticipated until next month, when an increase in the coal allowance is promised. In the most favourable circumstances British steelworks' capacity is not sufficient wholly to satisfy the needs of the sheet works and re-rolling mills, and, until more material can be obtained from overseas, re-rollers' operations cannot be fully sustained. Prospects of increased imports are still bleak, but the quest for overseas supplies is being pursued with unremitting energy, and some relief may be forthcoming after midsummer. Meanwhile, the position is most difficult, the lack of billets and sheet bars being reflected in a growing scarcity of sheets, strip and light sections.

Orders for all classes of heavy rolled steel are far in excess of present capacity. For three months past works have been unable to maintain normal deliveries, and although for a time consumers were able to keep going with material in stock, they are now involved in grave difficulties. Even the shipbuilding industry is no longer included in the first priorities. The motor industry, too, is handicapped and export quotas have been curtailed. Plate mills have work in hand which will keep them fully occupied for at least six months, rollers of railway and colliery equipment are working under considerable pressure, and the demand from tube makers and power-plant producers is overwhelming.

Non-ferrous Metals

The suspension of the United States' import tax on copper, with its subsequent effect on prices, is causing some confusion in the copper fabricating industry. There would appear to be a triple price structure, with domestic consumers paying 24 cents per lb. for foreign copper, while some American producers continue to sell domestic metal at 21½ cents per lb., both prices on a delivered Connecticut Valley basis. At the same time, another group of American domestic sellers is getting an average price between the domestic and foreign quotations. Its customers are paying approximately 23 cents per lb.

It is unlikely that this unbalanced situation will obtain for very long, although the fact that the sales at the lower figure are understood to have been almost entirely restricted to subsidiaries of copper-producing companies, while at the same time the producing companies have sold to other American consumers at the higher level, does not alleviate the difficulties. Generally, however, the belief among the executives of the American copper industry is that the present high prices—24 cents per lb. has not been equalled since 1929, will tend to cut down consumption, and an approximate balance between supply and demand may then be possible.

In the United Kingdom home market, although there is a belief that copper prices may rise still further, there is, at the same time, a widespread distrust of the present price level, which is having some influence on events. This is shown in the demand for scrap from fabricators being less pronounced, and secondary smelters being disinclined to stock extensively.

Tin supplies in the United Kingdom seem to be adequate for customers' requirements, but the international situation is still tight. Exports from this country are still restricted to low levels. It is possible that this policy will be continued until the gap in Bolivian concentrate shipments is filled.

Production of most zinc products is less than orders, both actual and potential, would warrant, but fuel, labour, etc., are limiting any possibilities of expansion.

New Trade Marks

The following applications to register trade marks appear in the "Trade Marks Journal":—

"NU-HEATHER" and "NU-REX"—Ranges, stoves, fireplaces, etc. GRAHAMSTON IRON COMPANY, LIMITED, Grahamston Iron Works, Falkirk.

"RAINALL"—Heating, steam generating, ventilating, etc., installations. RAINWATER CASTINGS, LIMITED, Margaret Street, Ashton-under-Lyne.

"LAPCO"—Metal ingots. LIGHT ALLOY PRODUCTS COMPANY (BIRMINGHAM), LIMITED, Forge Lane, Kingsbury Road, Minworth, Birmingham.

"WESTOX"—Alternating electric current rectifiers. WESTINGHOUSE BRAKE & SIGNAL COMPANY, LIMITED, 82, York Way, King's Cross, London, N.1.

"CROLTITE"—Machine tools, mechanical and hydraulic clamping devices, and grinding wheels. CROLT ENGINEERING, LIMITED, Waterloo Street, Bolton.

"VICTOL," "CERTEX" AND "CELLEX"—Powders, mould and core dressings and finishes, etc. HARBOROUGH CONSTRUCTION COMPANY, LIMITED, Harbilt Works, Logan Street, Market Harborough, Leics.

MR. GEORGE MALLATRATT, who was cashier of the Meadow Foundry Company, Limited, Mansfield, has died after a short illness. He was in his 62nd year and had been in the service of the company for 42 years.